Consulting Engineer

March 1957

pread the Talent

ARROLL A. FARWELL, Treasurer of Fay, Spofford & Thorndike, Inc., Boston, Mass., is a Past President of the American Institute of Consulting Engineers, the Northeastern Sec- on of the American Society of Civil Engineers, and the Engineering Societies of New England. fter receiving his degree in civil engineering from Massachusetts Institute of Technology in 006 (then known as "Boston Tech"), he worked for the Pennsylvania Railroad and the U. S.

—Continued on page 6

The Consulting Engineer's Professional Magazine

Inside Story on POWELL STEEL VALVES

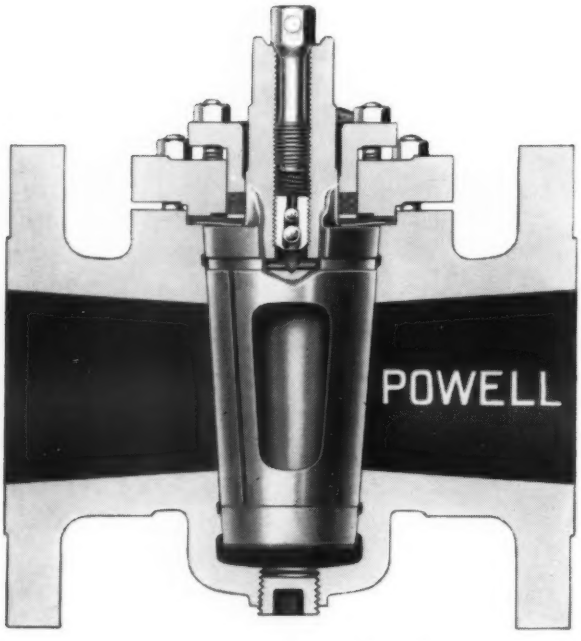

FIG. 3059--(Sectional)--A.S.A. 300-pound Steel Lubricated Plug Valve.

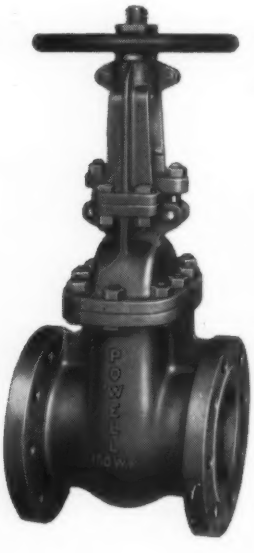

FIG. 2456 SS--OS&Y Gate Valve--1/16 Raised Face Separate Yoke Arms. Flanges are in accordance with ASA B16.5.

Steel Valves may appear similar on the outside. But their performance may be quite another story--for there can be a big difference in the metal, in design and in manufacture. And the inside story on Powell Steel Valves is that every valve has PERFORMANCE VERIFIED.

Only the finest materials are used in Powell Steel Valves. And painstaking quality control is rigidly enforced through each step of manufacture. For example, every machining operation is accurately gauged. All parts are thoroughly cleaned and degreased. As a final step in manufacture, EVERY POWELL STEEL VALVE IS GIVEN AN ACTUAL LINE TEST.

Because of Powell's painstaking quality control, plant shutdown through valve failure is practically unknown. Records from refineries, power and industrial plants the world over prove it.

Consult your Powell Valve distributor. If none is near you, we'll be pleased to tell you about our COMPLETE quality line which has PERFORMANCE VERIFIED.

Fig. 2433 SS--Stainless Steel Bolted Cap Swing Check Valve for 150 pounds W.P.

PERFORMANCE PV VERIFIED

The Wm. Powell Company, Cincinnati 22, Ohio . . . 111th YEAR

POWELL VALVES

BRONZE, IRON, STEEL AND CORROSION RESISTANT VALVES

VOLUME 9 NUMBER 3

NBP Published by BPA

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March 1957

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The Consulting Engineer's Professional Magazine

Carroll A. Farwell —

Starts on front cover

Reclamation Service. When the first World War started in Europe, Farwell and his wife and daughter were living in Spain, where he was employed by a Canadian firm as an engineer on a hydro-electric project near Barcelona. They returned to the U. S. at the beginning of World War I on a refugee boat, with no job and no money. Farwell took a "fill-in" job with the year-old firm of Fay, Spofford & Thorndike. Much to his surprise, he's been there ever since.

First Large Job

In 1918, the partnership had received its first large job — design and supervision of construction of the Boston Army Base ($20 million) — at which time it enlarged its force of 21 employees to over 150. After completion of the Memorial Bridge at Springfield, Mass., in 1922, on which Farwell was resident engineer, he was admitted to partnership along with several other staff engineers including John Ayer, Ralph W. Horne, and Bion A. Bowman. In 1947, due to increased business, three long-time employees were made partners: William L. Hyland, Frank L. Lincoln, and Howard J. Williams. These seven men guided the policies of the company, along with Spofford, one of the original partners, who retired shortly thereafter.

Incorporation

In April of 1956 the firm was incorporated as Fay, Spofford & Thorndike, Inc., primarily to allow the firm to bring new people into top management positions. At that time, five senior engineers — Messrs. Beebe, Cahaly, Jones, Keane, and Turner — were elected to the Board of Directors, and these men, together with the former partners, now make up the Board of Directors of 12 men who direct the operations and determine the policies of the firm.

The partners felt that under the corporate structure it would be possible to spread the work load and responsibilities to a greater extent, allowing for further expansion of the firm. The partnership will continue to function on projects where it appears advisable to do so.

Present Projects

Among the largest civil engineering firms in the country, FS&T has designed facilities ranging from buildings for atomic reactor research to complete military bases in Alaska, Newfoundland, and Labrador, municipal sewerage and water systems, airports, highways, piers, NIKE sites, and industrial plants. Among the many projects on the boards at the present time are: design of the Boston Central Artery, an inner-belt highway through downtown Boston, that is being done in cooperation with another engineering firm; extension of the New Jersey Garden State Parkway to meet the New York Thruway; sections of numerous other turnpikes and toll roads; and a $20 million drydock capable of handling ships of the Forrestal class; plus improvement of piers and waterfront facilities.

When Farwell joined the firm it did mostly structural engineering work, specializing in bridges and sanitary engineering. As the staff was increased, other types of work were sought in order to diversify activities. As Farwell himself says, "Over specialization combined with too rapid expansion to handle large jobs can be fatal to a consulting engineering firm of any size.

Danger of Over Specialization

"Take the Federal Highway Program, for instance. It is a temptation to concentrate on large projects such as turnpikes, interchanges, and big bridges. But what happens when such work slacks off? Then all your eggs are in one basket. We try to work in all phases of civil engineering, not just one, in order to insure a solid growth for our firm and continuity of employment for our people.

"After the second World War the danger of overspecialization was brought home to many consulting firms that had been doing work for the armed services. The War ended and so did the work. When the war work lightened, we transferred our activities to other fields of engineering. In the last ten years we have designed more than half the small airports in New England. We increased our activity on water and sewerage projects, and have completed or are now working on systems for many large and small northeastern communities.

Take Small Jobs Too

"Taking both large and small jobs has proved wise in many respects. First of all, as a professional man, an engineer has a responsibility to the area in which he operates. How are small municipalities to get first class engineering service and advice if competent engineers feel that these jobs are too small to bother with? Then, too, since a consultant does not advertise, good contacts, even on small projects, may prove important in the future.

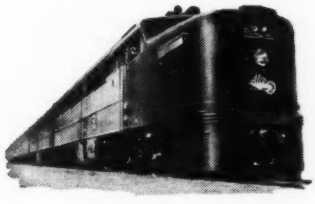
Training for Responsibility

"These smaller jobs also are an aid in training our engineers, giving them a broader background.

"We make a practice of developing our own staff members to take more responsibility. We seldom bring in men from outside to take positions of authority. We have an interesting arrangement with Northeastern University whereby engineering students work for us for 10 weeks and attend classes for 10 weeks. After graduation, many of these young men join our organization on a full time basis. In the years to come some of these students may become

SINCE 1888 ALCO Has Said:

"Steam Supply by B&W"



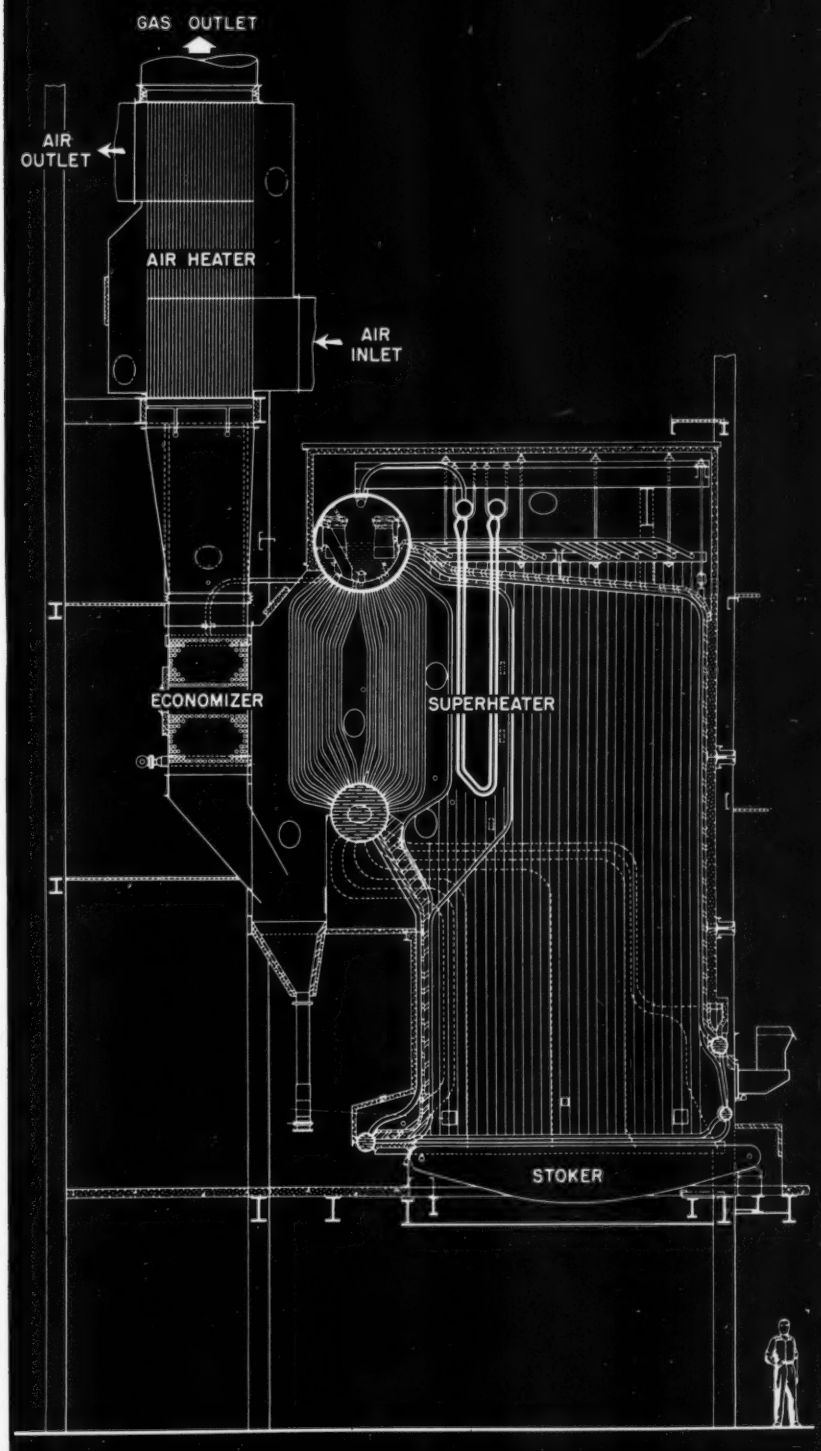
Back in 1888, when the *American Type* locomotive was setting speed records on passenger runs, B&W sold its first boiler to Schenectady Locomotive Works, predecessor of ALCO Products, Inc., to serve the plant.

In January 1955, two more B&W Two-Drum Stirling Boilers went on the line at the company's Schenectady plant. They are providing 100,000 lb of steam per hour for heating, for driving plant auxiliaries, and for some power generation. They bring the number to 40 B&W boilers in ALCO and its predecessors' plants.

What's Interesting about these two latest B&W boilers at ALCO is that they have operated at higher efficiencies than the design contract specified. To ALCO, with its long experience with B&W boilers, this was no surprise.

Long Range, Sustained economy—the product of the top level engineering design found in every B&W boiler—has become something to be expected by long time B&W customers.

More and more manufacturers, in the widest variety of lines, have learned, over the years, to depend upon B&W for an efficient, dependable source of steam. Whatever your steam needs may be—for heating, processing, or power generation—B&W engineers are ready to give you counsel, with nearly a century of steam generation experience behind them. The Babcock & Wilcox Company, Boiler Division, Dept. ME-2, 161 East 42nd St., New York 17, N. Y.



BABCOCK & WILCOX

BOILER DIVISION

G-771

directors or key staff members of the corporation.

Cooperation with Universities

"Engineers in New England have a definite advantage in being able to work closely with the engineering departments of fine universities. We have found that such schools like to have their professors work with us in a consulting capacity. Currently, Dr. John B. Wilbur, head of the Department of Civil and Sanitary Engineering at MIT, serves as an Associate of our firm, and Professor James Holt, Executive Director of the Department of Mechanical Engineering at MIT, as a Consultant.

"Dr. Wilbur works with us on special structural problems and advises on new and better ways of handling structural projects. Incidentally, he and members of our staff have been investigating the possibility of using electronic computers for solving such engineering problems as stresses in indeterminate structures and the large number of computations connected with highway design. Professor Holt lends his knowledge on mechanical problems and keeps us advised on new developments.

"This type of relationship is particularly important on projects such as the U. S. Air Force Base at Goose Bay, Labrador. This is an entire community in itself. For it we designed 303 separate structures, including the Airmen's Dormitory Complex containing living quarters and recreational facilities for over 700 men. Designing of north country facilities takes special knowledge and engineering skill. The Airmen's Complex was designed with an exterior of anodized aluminum panels so that the shell of the building could be erected during the short summer season and work continued on the interior during the winter.

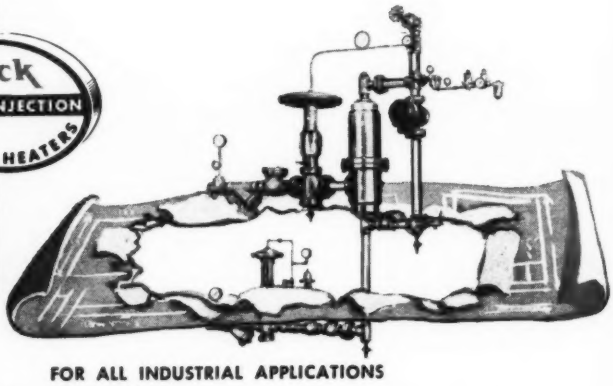
Association with Architect

"On projects of this type we work with Harold C. Knight, AIA, an architect who originally was a member of our organization but who since has opened an office of his own. In this way we can offer all the engineering and architectural service on any size project.

"With the formation of the corporation and the attendant diversity of engineering experience offered by our twelve directors, we look forward to a future of solid growth and accomplishment." ▲▲

Specify "SAVINGS" for your clients!

Pick STEAM INJECTION WATER HEATERS



INSTANTANEOUS HOT WATER HEATER

Show your client how to save on maintenance and operating costs with a Pick Instantaneous Water Heater. No lost time waiting for water to heat; no lost heat from water standing in storage tanks; no wasted floor space. Designed for high pressure steam (40#-125# psi) the Pick Heaters are the most efficient water heaters your clients can use. Check these other outstanding features.

- Instantaneous Hot Water — no waiting, water is heated in a flash to exact temperature, in volume required.
- No Storage Space — compact design permits out-of-the-way installations in corners, on walls, overhead, etc.
- Maintenance Cost Is Low — can be cleaned in minutes, worn parts easily replaced.
- Exact Temperature Control — Pick Heaters can be operated at high or low loads with minimum temperature fluctuations. And it's done quietly.
- Installation Is Inexpensive — only ordinary pipe connections are required.

FOR ALL INDUSTRIAL APPLICATIONS

Primary Heater
A primary source of hot water up to 300 gallons per minute at 140° F. rise.

Supplementary Heater
Easy installation and accurate temperature control makes them invaluable for "spot" applications near point of use.

"Booster" Heater
To augment overloaded or inadequate facilities. Will automatically "boost" and correct temperature deficiencies.

Mail this coupon today for further information on Pick Instantaneous Water Heaters, to:

PICK MFG. CO. Dept. CE-57
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Name.....

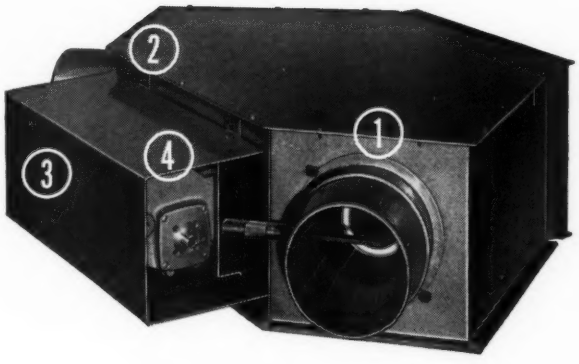
Company..... Title.....

Address..... City..... State.....

Please check below reason for additional information:

☐ Application ☐ File ☐ Other.....

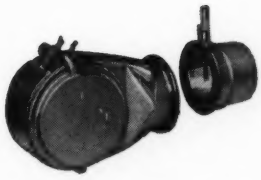
PICK MANUFACTURING CO. West Bend, W[illegible].



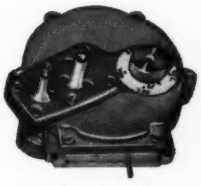
The complete blender

This is how the conventional packaged blender looks. From it you and your clients can expect controlled volume of air, constant CFM, long valve life and simplified control.

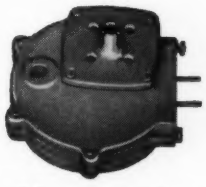
1. Cold Valve—(containing the diaphragm—the only moving part) controls the total air flow from the unit.



2. Hot Valve—like the cold valve, but with a scale on the variable orifice as part of *dial balancing* system.



3. Flow Regulator—with calibrated dial (CFM or inches of water) to preset total flow of the unit.



4. Submaster Regulator—similar to the Flow Regulator. Reacts to signals from room thermostat.

Revolutionary Dial Air Balancing—With New Honeywell Air Blender

Provides constant delivered air volume—one room can't rob air from another

WITH DIAL air balancing the room thermostat is now free to do its job right.

Occupants get the level of comfort they call for. And it doesn't come at the expense of some other room. It comes from the system. *One room no longer "robs" another of comfort.*

Self-powered, the Honeywell Air Blender uses the air pressure of the high velocity air it is controlling to actuate its diaphragm—its only moving part.

For further information about Honeywell High Velocity Air Blenders and other Honeywell heating and air conditioning products, call your local Honeywell office. Or write to Honeywell, Dept. CO-3-46, Minneapolis 8, Minnesota.

Room thermostat—
the Honeywell Round

The "new" look in thermostats that's appearing on walls of commercial buildings throughout America. New design *inside* gives closer control, vastly superior performance.

MINNEAPOLIS **Honeywell**

112 offices across the nation

First in heating-cooling controls

Only Honeywell gives you all four—pneumatic, electric, electronic, instruments.

The Reader's Guide

Flying Surveyor

The age of the flying surveyor is upon us. Photogrammetry has developed to the point where its accuracy will permit it to be used to pay contractors for cut and fill on highway work. You photograph the area from a plane before the job is started, then photograph it again after it is complete. A comparison of the two aerial photographs, making use of special equipment, permits accurate computation of the amount of earth moved. William Baker, of Michael T. Baker, Inc., heads that firm's photogrammetry department, and he tells in an article in this issue (page 60) how a difficult terrain can be quickly and easily surveyed by airplane and camera.

Towers That Don't Fall

While we did not plan it that way, we have a timely topic in Professor Fiesenheiser's article on the design of tall guyed towers, published on page 64. Towers are falling like ripe fruit these days. But the author's towers are all still standing, and it will be worth your time to find out how he goes about the analysis and design of a tall tower that will stay in its proper upright position, come what may.

The Canal And Its Builder

Another timely topic is the Suez Canal. The Canal is a 19th century engineering accomplishment that currently is the key to world peace — or war. Shu-T'ien Li, the author of "De Lesseps and the Suez Canal," page 88, is a student of history — engineering history in particular — and is an eminent engineer, well known here and abroad. He is currently with Palmer and Baker, of Mobile. While this article tells a great deal about the Canal and its designer, those interested in learning even more can get the book, *De Lesseps of Suez,* by Charles Beatty, just published by Harpers, at $4.50. We will order a copy for you, if that would make it easier.

Dealing With The World Bank

After quite a struggle, we can now publish a full story on the World Bank and its way of dealing with consulting engineers. You will find that the Bank is not set up to hand out favors by selecting the engineer for any of the projects it finances, but someone is going to get that work, and you should know how it's done. Even more important to the small or average size consultant is the newly formed IFC, lending money only to private enterprise for establishment of foreign industry. They have a healthy attitude toward engineering advice. See "Dealing With the World Bank," page 72.

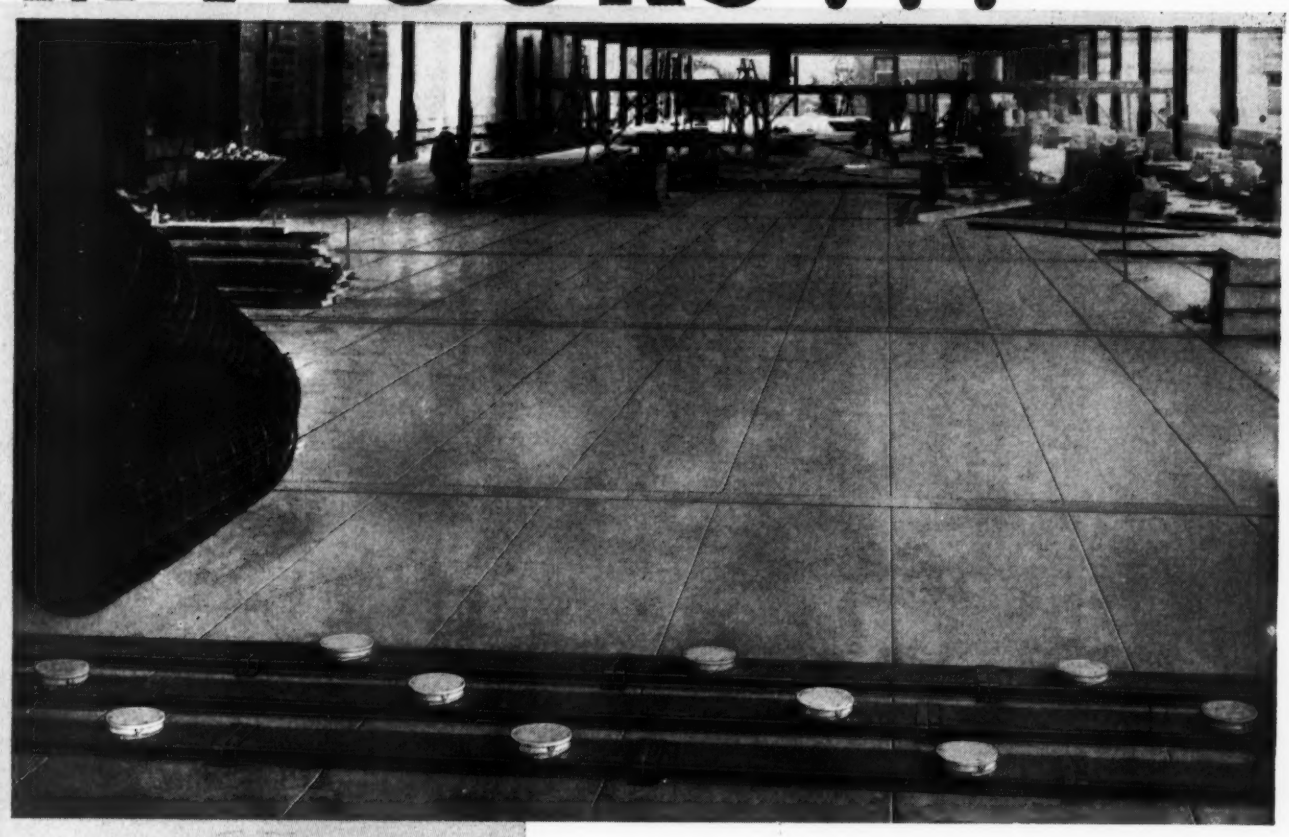
Don't Think!

Atomic energy legislation has put every engineer who is thinking about applications for nuclear energy in serious danger of spending the rest of his life in jail. All you have to do is to dream up a good idea in this field and tell it to a friend, and Leavenworth is ready to accept your reservation for a room without bath. While it is unlikely that Congress really intended to stop all thought on atomic applications, the law is on the books. Before you start concentrating on atoms, you better read "Legal Aspects" in this issue. The facts are frightening.

The Word From Washington

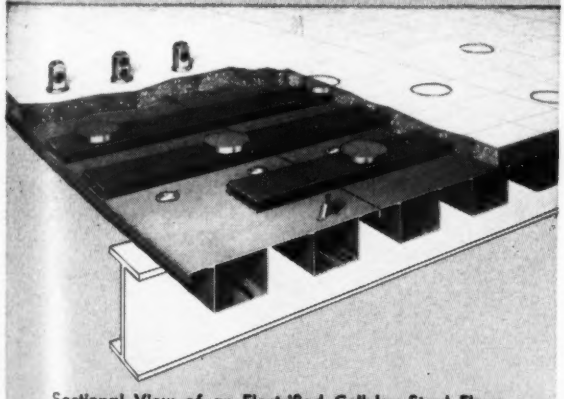
We are starting a new department this month, a report from the Capital called "The Word from Washington." You will find in it much of interest to the consulting engineer. Each month, Edgar A. Poe (that's right, the middle name is Allen) Washington correspondent for the New Orleans *Times-Picayune,* will give the word as he hears it. Ed Poe has been around Washington for a long time, and he knows what is going on from cloakroom to cocktail party. Ed has been associated for many years with Paul Wooten, Dean of Washington Journalists, so he has the contacts and knows the sources.

M-FLOORS . . .



YOUR Logical Choice for Electrified Cellular Steel Sub-Floor Construction!

The construction view above shows Mahon M-Floor installation in a modern Four Story Office Building for Kansas City Life Insurance Company, Kansas City, Missouri. Mahon Long Span M-Deck was employed in the Roof Construction. Edward W. Tanner & Associates, Architects. Collins Construction Company, General Contractors.



Sectional View of an Electrified Cellular Steel Floor Constructed with Mahon M-Floor Section M2, and Energized with a Three Header Duct Electrical Distribution System. Mahon M-Floor Cel-Beam Sections are available with either Two or Three 6" wide Cel-Beams in a 24" width, and in several Beam Depths to meet virtually any structural requirement.

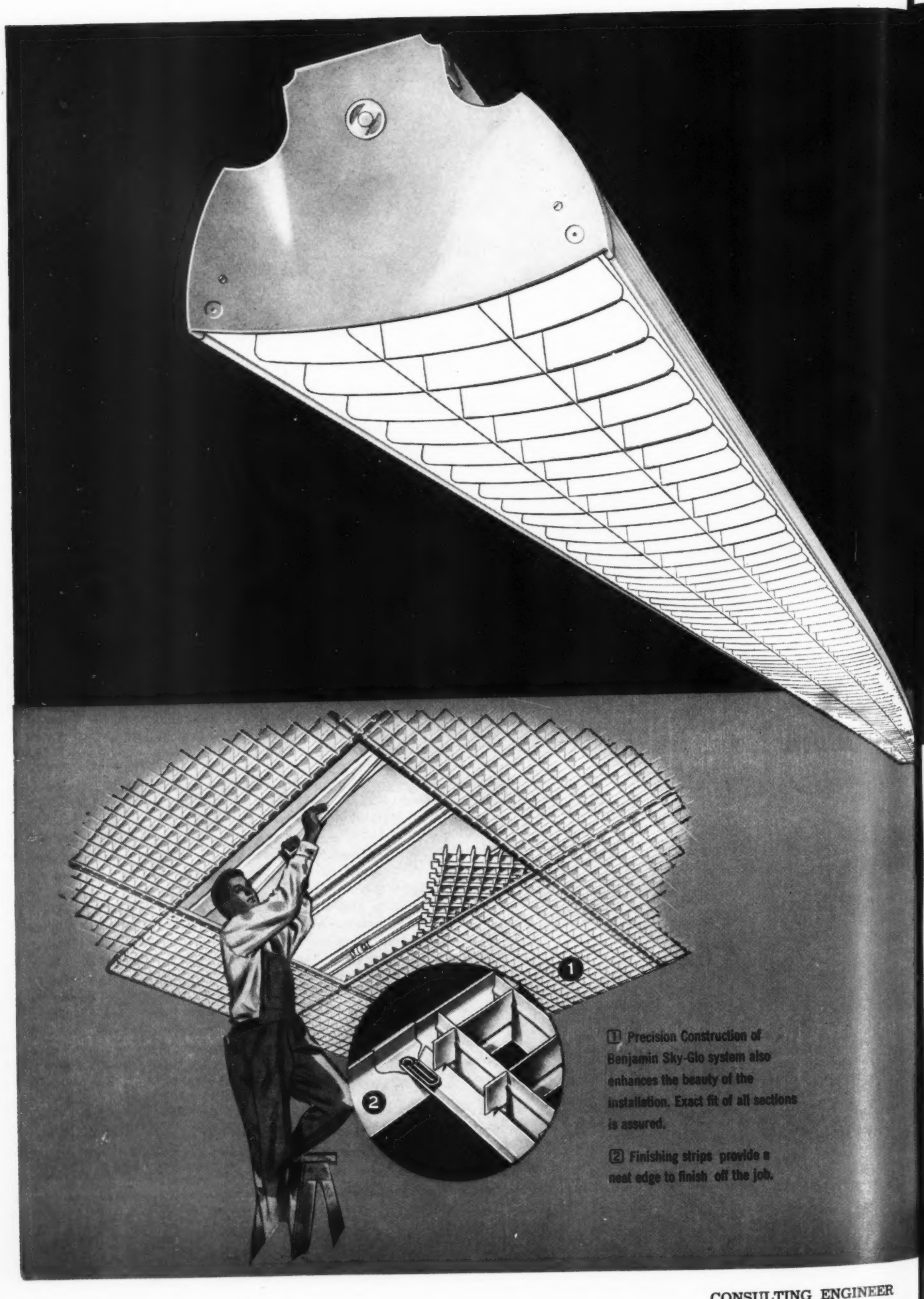
When you build with M-Floors, you serve your client in the true tradition of your profession . . . you reduce the cost of his building through the inherent advantages of light weight floor construction . . . you build into his building the convenience of all-over electrical availability provided by the Cel-Beam Raceways in the Structural M-Floor . . . and, you insure his building against electrical obsolescence. These are the basic reasons why M-Floor construction is employed today in so many multiple story buildings. Why do engineers select M-Floors? . . . here are some of the reasons: Mahon M-Floor Cel-Beam Sections are designed to give you a better Section from a structural, electrical, and general utility standpoint. The flat Top Plate of the Mahon Section reduces both the amount and weight of concrete topping to a required minimum. The Cel-Beam Members of Mahon M-Floor Sections are 6" wide with perpendicular beam-webs. This permits greater latitude in the installation of Floor Service Fittings . . . it also permits 4" diameter access hand-holes between Header Ducts and Cel-Beam Raceways. The 6" wide Cel-Beam Members further provide adequate and evenly distributed beam-web supports for the flat Top Plate at not more than 6" on centers. Compare these points, one by one, with any other Cellular Steel Sub-Floor available today, and you, too, will be convinced that the basic functional requisites of a Cellular Steel Sub-Floor have been more fully realized in the design of Mahon M-Floor Cel-Beam Sections. See Sweet's Files for complete information and engineering data, or write for Catalogue M-57.

THE R. C. MAHON COMPANY • Detroit 34, Michigan

Sales-Engineering Offices in Detroit, New York and Chicago • Representatives in Principal Cities

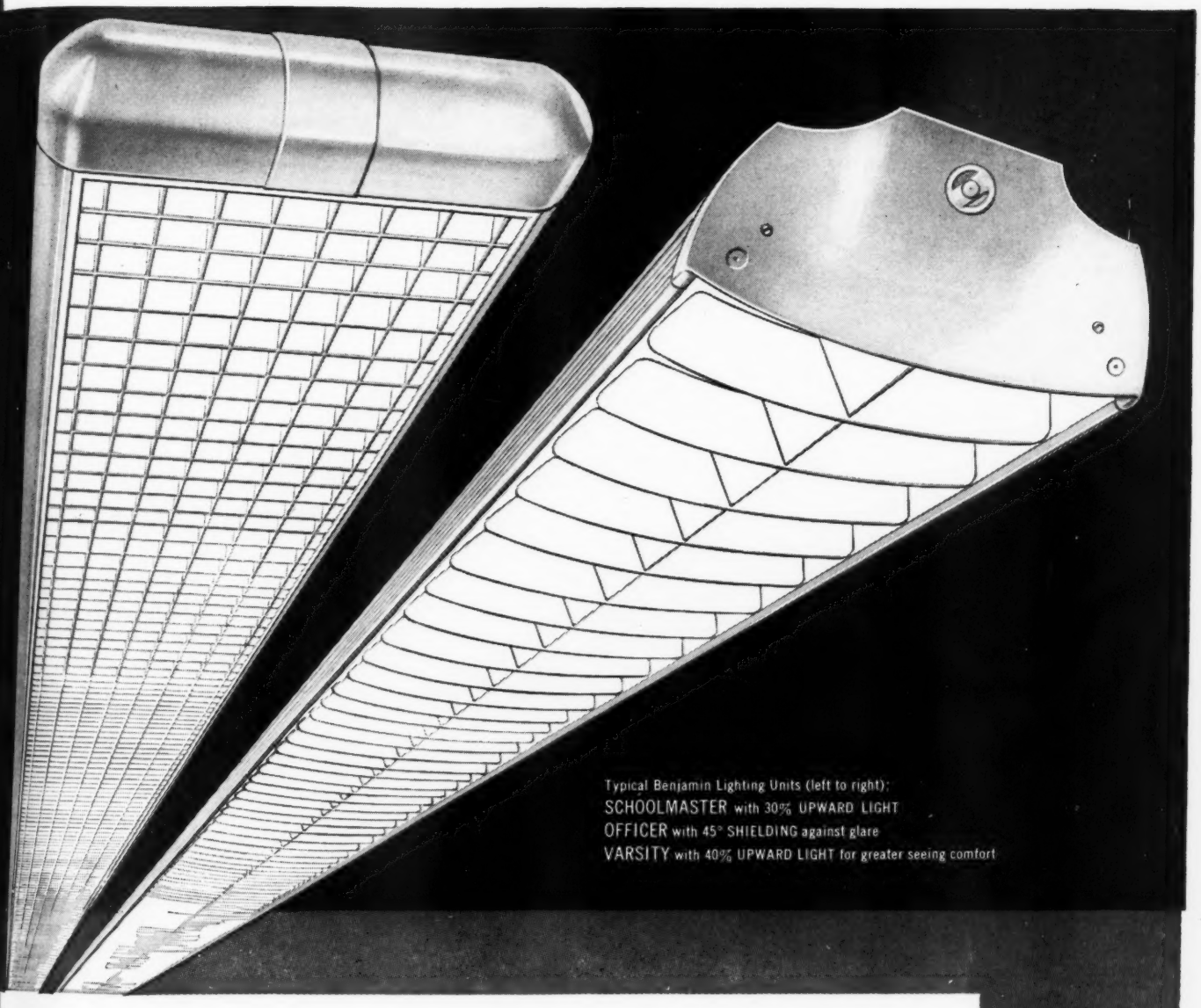
Manufacturers of Electrified M-Floors; Steel Roof Deck and Long Span M-Decks; Acoustical and Troffer Forms; Concrete Floor Forms; Insulated Metal Walls; Underwriters' Rated Fire Walls; Rolling Steel Doors, Grilles, and Underwriters' Labeled Automatic Rolling Steel Fire Doors and Fire Shutters.

MAHON



1 Precision Construction of Benjamin Sky-Glo system also enhances the beauty of the installation. Exact fit of all sections is assured.

2 Finishing strips provide a neat edge to finish off the job.



Typical Benjamin Lighting Units (left to right):
SCHOOLMASTER with 30% UPWARD LIGHT
OFFICER with 45° SHIELDING against glare
VARSITY with 40% UPWARD LIGHT for greater seeing comfort

When all things are Considered, the Better Lighting choice is

BENJAMIN

Compare Construction features like these; you get them all in the new Benjamin Lighting Units:

• **no fiddling with fancy louver hinges and catches:** Simple piano hinge and quick-action catches assure trouble-free opening and closing of louvers.

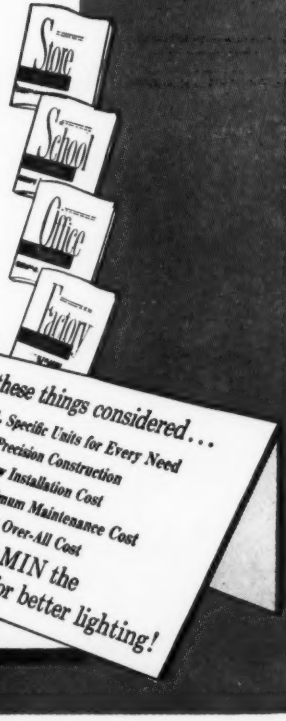
• **no "swing and sway" installations!** Benjamin precision construction assures accurate alignment of units . . . embossed channels for extra rigidity.

• **no lost motion or manpower!** All the knockouts needed are there and are conveniently located . . . no need to drill new mounting holes, either.

• **no plastics problems!** Plastic louvers are precision-molded by a patented process—always fit, will not warp.

Scores of advantages like these in every Benjamin unit are proof of Benjamin precision construction. Add the other four major areas of Benjamin superiority, and you will agree with leading users everywhere that "when *All* things are considered, the Better Lighting choice is Benjamin!"

Send for one or more of these Free lighting booklets. Write: Benjamin Electric Mfg. Co., Dept. CEN, Des Plaines, Ill.



B-1040

Benjamin Lighting Equipment is sold exclusively through Electrical Distributors.

READERS' COMMENT

So Called Education

Sir:

Your "Scraps and Shavings" editorial in the February issue is very pertinent, and seems to indicate that you know how a consulting engineer's office really operates.

I know that in my case I spend much more time than I should on details and on drafting, all because of my intense desire to turn out a professional-looking set of drawings, as well as a correct set of drawings that will not cause any puzzlement when used in the field.

However, I find that my personal application is necessary, because the basic concept that "a drawing is a message" is sadly lacking in the so-called "education" evidenced by graduates of modern-day engineering schools. The lack of drafting skill in engineering graduates is deplorable — in fact abysmal.

I find it necessary to train them in elementary drafting techniques they should have learned in school, especially in "lettering." The hen-scratches they turn out definitely show that they did not have any competent training in school, and that there was no effort expended to make them practice to the point where they could do a presentable job, and develop an acceptable "fist."

I think that your magazine should start a strong campaign to urge the schools to face reality and start turning out engineers who can properly communicate in the language of engineering — drafting and lettering.

The schools apparently have the idea that their graduates are going to stand on a mountain-top, clad in corduroy breeches, high-top boots, and campaign hat, clutching a roll of blue prints, and pointing dramatically off into the distance. The reality is that most of the graduates are going to spend some time on the "board," turning out the tracings from which the above-mentioned blue prints were made, and the schools should teach them to do a good job.

Maurice B. Cook
Consulting Electrical Engineer
Chicago, Ill.

Case of the Missing Issues

Sir:

We are very much interested in securing all back copies of CONSULTING ENGINEER prior to the November 1956 issue, and would appreciate, in the future, if we could obtain two copies monthly. Are binders available for these issues?

Our copies of CONSULTING ENGINEER seem to have a habit of wandering away, never to return. We would like one copy to keep locked in our bookcase for reference and the other to leave out for those of our staff who wish to use it. Your magazine, when we can locate it, is in constant usage and offers us many invaluable suggestions.

We would like to express our sincere thanks for CONSULTING ENGINEER and we are anxiously awaiting our next issue.

T. C. Biebesheimer
T. C. Biebesheimer Engineering Co.
Toledo, Ohio

• BINDERS FOR 12 COPIES EACH ARE AVAILABLE FOR $3.00

Michigan CE Association

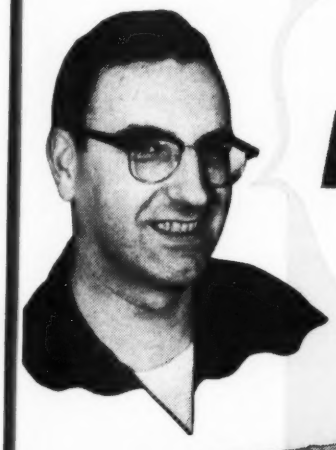
Sir:

. . . I have been spearheading an effort to form an Association of Michigan Consulting Engineers, to become affiliated with the national Council. I have been working under

WHEN you install Vikings, there's no wasted time with slow, uncertain priming . . . you start delivering in seconds. Delivery is then smooth and constant. There's no spasmodic operation to cause damage to valves and meters. And to finish, you can strip a tank fast and completely with positive Viking Rotary Pumps. They are built to pump all liquids, thick to thin.

To start, send today for pump catalog 57Sp.

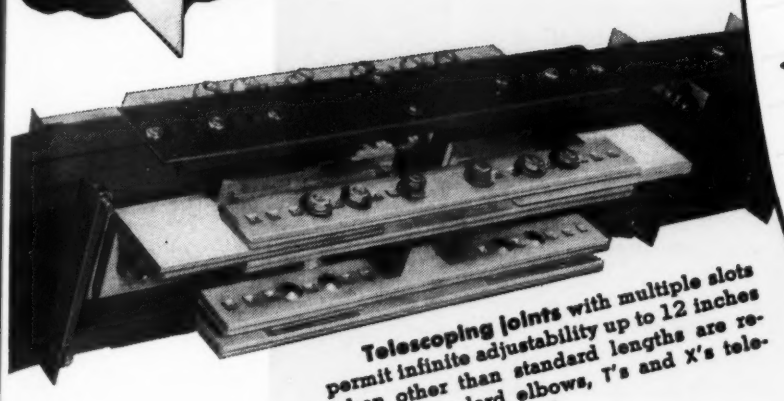
VIKING PUMP COMPANY
Cedar Falls, Iowa, U.S.A. In Canada, it's "ROTO-KING" pumps
See our catalog in Sweets



Here's Why Square D's New Adjustable

ALUMINUM FEED-IN DUCT

makes a lot of sense to me!



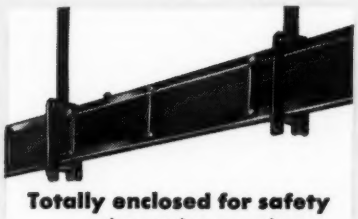
Needed-Rush! 85 feet; 3½ inches 1000 Amp, 3φ4 wire Feed-In Duct

Telescoping joints with multiple slots permit infinite adjustability up to 12 inches when other than standard lengths are required. Standard elbows, T's and X's telescope up to 6 inches!

Fast delivery because any length requirement can be met with standard 3, 5, 7, or 10 foot lengths, plus telescoping joints

Completely adjustable after it's hung. For example, if two ends terminate 6½ inches apart, connection can still be made with a telescoping joint

Faster to install • Above photo of fixed joint shows simplicity of design—symmetrical ends—less bars per phase—fewer connections—outward-facing captive bolts



Totally enclosed for safety—at no price premium. No de-rating necessary. Square D's design eliminates need for ventilation

MORE DESIGN FEATURES

Thinnest cross-section available! Tight spots, pipes and structural members present less problems

Easy transposition of phases, using standard telescoping joint parts, for maintaining balanced voltage on long runs

Certified short circuit tests by an independent testing laboratory have proved the superiority of Square D's continuously-supported bus design

Write for the complete story
Address Square D Company, 6060 Rivard Street, Department SA, Detroit 11, Michigan

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SQUARE D COMPANY

COOLING TOWER POWER
is most efficiently utilized by
Marley
Multi-Blade Aerfoil Fans

Marley fans are unexcelled for the job of converting applied power to actual cooling performance, but the qualities that make them positively distinctive are ultra-smooth operation and long-life durability. It requires just two words—MULTI-BLADE and AERFOIL—to point out the characteristics that produce these stand-out advantages.

Watch a 22-foot, 12-blade Marley fan operate; listen to it operate. The customary "huff and puff" pulsation of large fans is not there. There is no structure-shaking vibration. The result? Longer life for speed reducer, drive shaft, fan cylinder and structure. That is the multi-blade advantage.

The Marley fan is inherently rugged and durable. Each blade is a single casting, a rigid, homogenous unit of specially selected aluminum alloy that retains its aerfoil shape permanently. Marley fans never develop tip-sag or service flutter. The design completely eliminates weld and rivet failures, skin cracks, imperfect laminations and internal corrosion.

All machine operations on Marley blades and hubs are carefully quality controlled. Blade surfaces are protected by a double-coated baked plastic finish. Each fan is balanced at the factory and match-marked for field assembly.

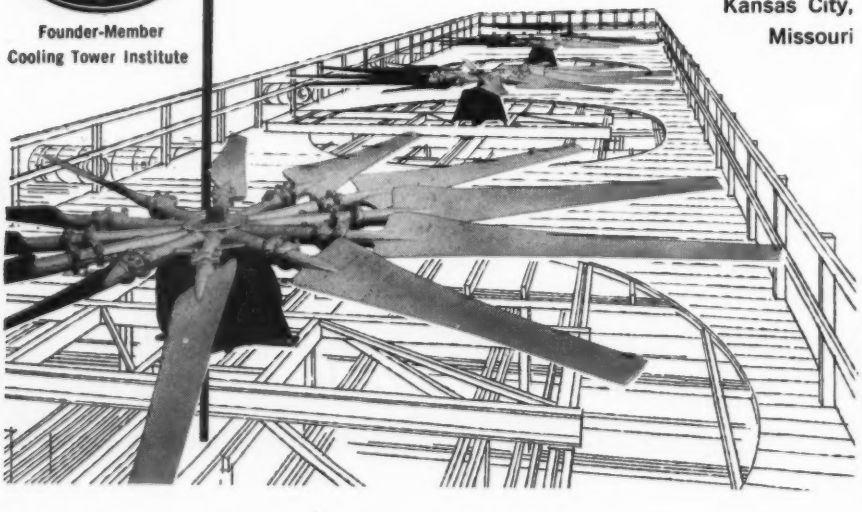
Owners of towers of all types and makes are modernizing their equipment by changing to Marley Multi-Blade Aerfoil Fans—often after side-by-side comparative test with present equipment. Write for Bulletin FH356 and get the complete story of modern design applied to cooling tower fans.

MARLEY

Founder-Member
Cooling Tower Institute

The Marley Company

Kansas City,
Missouri



the direction of Mr. T. E. Roche and Mr. Hueston M. Smith of the Consulting Engineers Council. I have obtained names of several engineers so interested but we must have fifteen more, at least, before the first organizational meeting can be assured of success.

If you would be of assistance by inserting a small news item of the proposed organization and ask such interested persons to write me, I will be glad to answer their inquiry as to the proposed organizational meeting, which will be in early April. Benefits of the proposed association would be: (1) concerted effort to enhance the profession of consulting engineering, (2) annual conferences on mutual problems and ethical matters pertaining to the profession, (3) discussion of relationship of the consulting engineer to the "sales" and other employed engineers, and other legal matters, (4) group insurance rates for "errors and omissions" insurance, and (5) independent investigation of matters which concern the integrity and welfare of the consulting engineering profession.

W. B. MacWhirter
W. B. MacWhirter & Associates
1017 Cottage Grove St., S.E.
Grand Rapids 7, Mich.

Not Chairman

Sir:

Your "Readers Guide" comments on my article "We Oppose Corporate Practice" in your February issue refers to me as chairman of the Joint Professional Committee for the study of the Education Law. This is an error. The introduction to the article correctly states my position on the Committee; a representative of the New York State Society of Professional Engineers.

Mr. Louis G. Gitzendanner, the other NYSSPE representative, is the chairman of the Joint Committee.

James P. O'Donnell
Consulting Engineer
New York, N. Y.

Hindsight

Sir:

The following is quoted from an interview with General Sverdrup reported in your February issue.

"As soon as the job is finished, put some of the men to work trying to find out how the job could have been done better."

In our relatively small organization, there is little opportunity to engage in what might be called research. However, after the comple-

Engineers from Blaw-Knox and Arthur D. Little, Inc., make intermediate check on data as operator (on left) watches signals on control console of electronic computor

Power Piping Division develops

new "6 x 6" Flexibility Matrix Method —cuts calculation time from months to a day

Present day operating requirements demand power piping systems that can handle extremely high temperatures and pressures—often up to 4500 psi and 1100° F. Under these critical conditions pipe may expand as much as ten inches in a hundred feet of pipe.

To be sure of adequate flexibility of the piping system, the terrific stresses set up by this expansion must be accurately computed before fabrication. And these computations are often so complex that skilled stress analysts have had to take two to three months, sometimes more, to complete them.

Now, by using the Blaw-Knox "6 x 6" Flexibility Matrix Method, computation time is cut to one day.

Developed in an 18-month joint research project of the Blaw-Knox Power Piping Division and the Arthur D. Little, Incorporated, Cambridge, Mass., research consultants, this new method of computation takes advantage of the high speed and accuracy of electronic computers.

Results are: Completely automatic computation with no limitations on the complexity of the systems. Full accuracy—as any inconsistencies in the input data are detected by the machine and all results are carried to six significant figures. Tremendous saving in time. Highly profitable saving in costs.

Originally developed for calculating stress analysis on systems fabricated or designed by Blaw-Knox Power Piping Division, this new method of computation is now available to consulting engineers, companies and individuals responsible for the design of power piping systems.

Bring your piping stress problems to our Power Piping Division for a discussion with our experienced piping engineers.

BLAW-KNOX

BLAW-KNOX COMPANY
Power Piping and Sprinkler Division
Pittsburgh 33, Pennsylvania

Complete facilities for prefabrication and erection of piping systems—complete line of functional spring hangers, assemblies and vibration eliminators—complete engineering and installation of Automatic Sprinkler Systems

Two more cities select··

CONSECO CONDENSERS

- **CITY OF DETROIT, MICHIGAN**
  One 27,500 sq. ft. condenser
- **CITY OF WASHINGTON, INDIANA**
  Two 8,500 sq. ft. condensers

This recent photo taken at our shop shows one of the City of Washington units being shipped, the other being fabricated —and the City of Detroit condenser being assembled.

These are small units, compared to many CONSECO has supplied, such as three of 70,000 sq. ft. each for the City of Los Angeles, Cal. . . . one 45,000 plus two 20,000 sq. ft. units for Puerto Rico . . . four 12,000 sq. ft. units and one 35,000 sq. ft. unit for Dairyland Power Cooperative . . . to mention just a few of scores of installations.

Big or small, CONSECO Equipment is the choice of Engineers who have well-placed confidence in CONSECO'S experienced engineering, sound design, dependable manufacturing and better performance. ***Descriptive literature on CONSECO CONDENSERS on request.***

Send for Bulletins giving complete engineering data on these products.

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HEAT EXCHANGERS • CONDENSERS • EVAPORATORS • STEAM JET AIR EJECTORS • CONDENSATE COOLERS • PRESSURE VESSELS SERVICE WATER COOLERS • FILTERS • STRAINERS • INSTRUMENTS, SPECIALTIES

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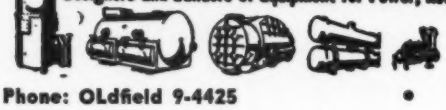
Designers and Builders of Equipment for Power, Refining, Chemical and Marine Industries



163 OBSERVER HIGHWAY
HOBOKEN, N. J.

Phone: OLdfield 9-4425 • **N. Y. Tel: BArclay 7-0600**

tion of some of our work, I did prepare a memorandum called "Hindsight Jottings" in which I recorded oversights and errors and ways to avoid them, and suggested improvements in the selection of equipment or layouts for use on future projects. The time spent on such a review is quite worthwhile.

Samuel J. Gates
Gates, Weiss and Kramer
Milwaukee, Wis.

Use of Manpower

Sir:

In perusing CONSULTING ENGINEER magazine, we find that a variety of articles are discussed therein.

One of the subjects we are vitally interested in, but have not found in your magazine as yet, is efficient utilization of manpower in an architect-engineer office.

Please state whether you have discussed the above subject in one of the past issues of your magazine.

Can you recall whether data concerning the above has been edited by others?

P. B. Janusz
Chief Mechanical Draftsman
Giffels & Vallet, Inc.
Detroit, Mich.

• WE HAVE SEVERAL ARTICLES ON THIS SUBJECT PLANNED. AS FAR AS WE KNOW, NO OTHER BOOKS HAVE CARRIED INFORMATION OF THIS TYPE.

Thank You!

Sir:

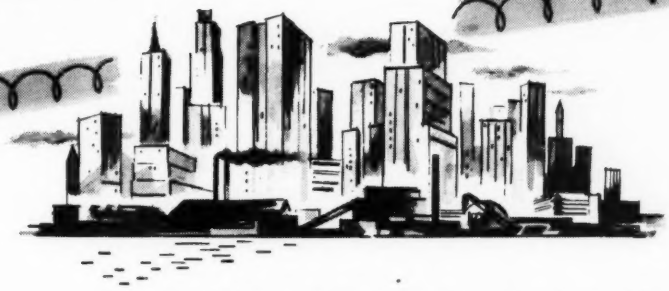
For the past year we have been receiving a copy of your CONSULTING ENGINEER and each member of our staff has found it most interesting and informative—we wish to thank you for forwarding this to us. We would also like to continue receiving this for the coming year and would appreciate your noting our change of address above to 924 Bankers Mortgage Building instead of 636.

A. Bahn, Jr., Associate
Parsons, Brinckerhoff,
Hall & Macdonald
New York, N. Y.

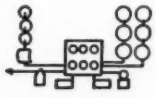
Sir:

I would appreciate receiving two copies of the "Errors and Omissions Insurance" reprint that is indicated in the January, 1957, issue as being available without charge. I wish to take this opportunity to compliment you on the fine job that you are doing in bringing to the attention of the engineering profession the other areas that must be considered in the performance of a complete engineer-

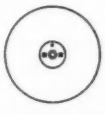
Edwards Signaling Equipment for "Reputation Insurance" in Factories and Office Buildings



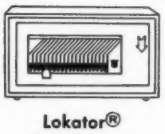
Horns



Fire Alarm Systems

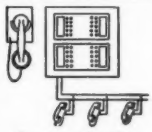


Adaptabel®

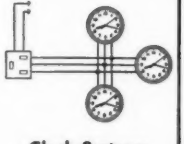


Lokator® Call Systems

Annunciators for Process Control



Communication Systems



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More than 80 years of experience provides the world's finest signaling equipment! It is this long period of accepted leadership that "insures" your reputation every time you specify Edwards signaling equipment.

Edwards long specialization in signaling is of particular value to you for commercial building and factories. In such installations, normally troublesome signaling problems are easily solved by maintaining uniformity of equipment. And only Edwards can provide you with an entire family of fine signal products. Horns, bells, signals, call systems, annunciators for process and production control, clock and scheduling systems and fire alarm systems are all designed and manufactured *complete* by Edwards.

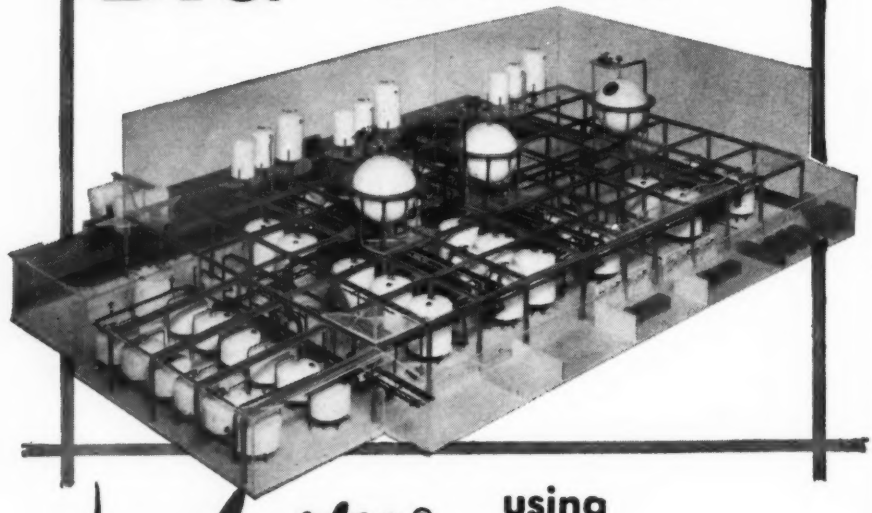
Edwards Technical Specialists in 53 key areas in the U. S. and Canada are available to work with you in planning and laying out specifications for all types of signaling systems. For a complete catalog of products, write to Dept. CE-3, Edwards Company, Inc., Norwalk, Connecticut. (In Canada: Edwards of Canada, Ltd., Owen Sound, Ontario.)

specialists in signaling since 1872

EDWARDS

DESIGN • DEVELOPMENT • MANUFACTURE

Model of
BIG DEMINERALIZER EFFICIENCY



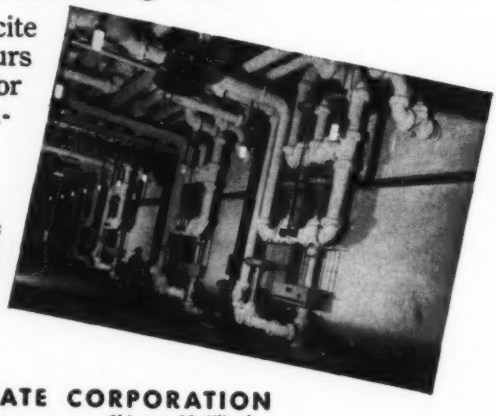
Nalcite® (DOWEX*) using ION EXCHANGE RESINS

BUILDING and operating a giant demineralization plant, like the one shown in model form above, are most impressive achievements. Unseen, yet vital, are the materials for which the whole plant is designed: the ion exchange materials used.

In this demineralizer, as in many other installations, Nalcite Ion Exchange Resins do the job efficiently . . . with both high capacity performance and outstanding resistance to attrition losses.

Whether your demineralization needs call for a pint an hour or thousands of gallons per minute—make sure the chemicals that do the job are Nalcite Ion Exchange Resins.

Technical data on Nalcite Ion Exchangers are yours for the asking. Write for this valuable information today.



The model grows up. Section of demineralizer plant modeled above—one of world's largest—showing some of automatic control features.

NATIONAL ALUMINATE CORPORATION
6180 West 66th Place • Chicago 38, Illinois
In Canada: Alchem Limited, Burlington, Ontario
*Reg. Trademark of The Dow Chemical Company.

Nalco

When you use Nalcite resins, you take advantage of Nalco's long and broad experience in water and process technology.

ing job, aside from the technical aspects involved.

I. Williams, P. E.
Burns and Roe, Inc.
New York, N. Y.

Sewage Lagoons

Sir:

I am anxious to get two or more copies of Mr. Joe Williamson's article on sewage lagoons appearing in your December 1956 issue of CONSULTING ENGINEER. It is the best article I have seen on the subject.

J. A. Lindsey
Consulting Engineer
Minneapolis, Minn.

Sir:

We recently have come in contact with your magazine, CONSULTING ENGINEER which, until yesterday, we have not heard about. A firm in our building has allowed us to borrow their December issue and we find many articles very interesting. This inquiry, therefore, has a twofold purpose:

To establish a method by which we can get on your mailing list.

To inquire as to the possibility of getting a copy of your December issue or possibly a copy or copies of the article "Sewage Lagoons are the Answer" by Joe Williamson, Jr. . . .

A. C. Becker
Truman Schlup, Consulting Engineer
Kansas City, Kans.

Times Ten

Sir:

In your February issue you carry a brief report on the high temperature hot water heating system at New York International Airport (p. 142). The material for this report originated from this office. The caption under the picture should read "Longest straight pipe run in system is 1100 feet" (Caption mistakenly read 110 feet).

Melvin Elliott
Fred Wittner Advertising
New York, N.Y.

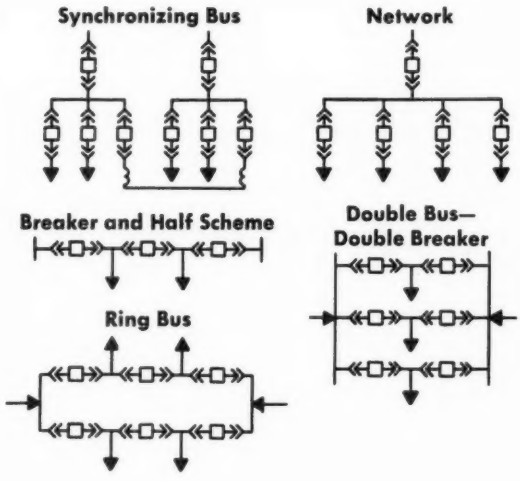
Up-to-Date

Sir:

Thank you for placing us on your mailing list to receive CONSULTING ENGINEER.

I have in the past taken a great interest in your magazine. I know of no other publication that is so up-to-date on engineers and their affairs and related issues. . .

Albert W. Daniels
Daniels, Brown & Hall
San Diego, Calif.



FUNCTIONAL SWITCHING SCHEMES FOR ALL MEDIUM-VOLTAGE APPLICATIONS

- Incoming Line and Service Entrance
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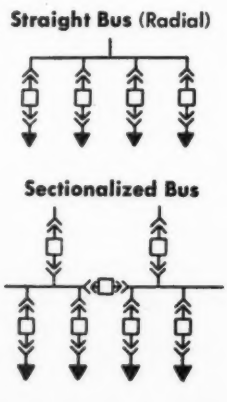
- Mercury Arc Rectifiers
- Arc Furnace Service
- Capacitor Switching
- Synchronous Condenser Control

APPLICABLE FOR: Power House Auxiliary Motor Control—Main Generator Control for Small and Medium Steam, Hydro and Gas Turbine Plants—Utility Distribution Systems—Waterworks and Sewage Plants—Oil Pipeline Pumping Stations—Refineries—Manufacturing Plants of All Kinds—Armed Forces Installations—Large Commercial Buildings—Shopping Centers.

Electric Metal-clad Switchgear handles any switching problem—economically!

These two switching schemes meet the basic requirements of most industrial installations, including textile mills, refineries, mining operations, and automobile and similar manufacturing plants. For more extensive and specialized applications, refer to the additional switching schemes shown above.



General Electric factory-assembled Metal-clad Switchgear is the best answer for switching schemes in the medium-voltage range of 2400 to 13,800 volts.

This universal application, combined with the advantages offered by standardized unit design, greatly simplifies engineering and installation of metal-clad switchgear equipment. Maintenance and operation present fewer problems because personnel have only to learn the details of one type of equipment. And with standardized design, spare parts requirements are minimized because one set of parts will serve for all installations. Removable Magneblast circuit breakers of like rating, for example, are interchangeable, so that one spare unit can serve for emergency use on numerous circuits.

General Electric Metal-clad Switchgear is built for rugged duty. It provides maximum protection for electrical systems and the highest level of safety for personnel. For full information on its many "plus" features, see your local G-E Apparatus Sales Engineer, or write for Bulletin GEA-5664 to General Electric Company, Section 511-20, Schenectady 5, New York.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Scraps & Shavings

A "USUALLY RELIABLE SOURCE" reports to us that at the recent meeting of the Consulting Engineers Council, in Atlanta, there was a committee appointed whose work should be of vital importance to all engineers in private practice. As we hear it, this committee was set up for the purpose of studying the advertising carried in various professional and trade magazines. The committee would ask all members of the state and regional associations of consulting engineers to keep their eyes open for ads that are either good or bad from the consulting engineer's point of view. These advertisements would be sent to the committee, who would then write a letter to the advertiser either complimenting him or condemning him for his statements.

The committee is particularly interested in advertisements offering "free engineering." Obviously, consulting engineers find such advertising obnoxious, and the committee, in contacting the advertiser, would point out that most engineers in private practice would avoid specifying the products of a manufacturer who offered to do the design work and specifying for a project "free." Since most manufacturers now recognize the consulting engineer as a powerful buying influence, there is reason to believe that they would heed the suggestions of the committee and change their advertising approach.

Within the past few years there has been a decline in the number of manufacturers openly offering "free engineering." We like to think that our own refusal to accept such advertising and our efforts to inform manufacturers of the dangers involved has had something to do with this change. The committee, however, will find that there is still plenty of work to do.

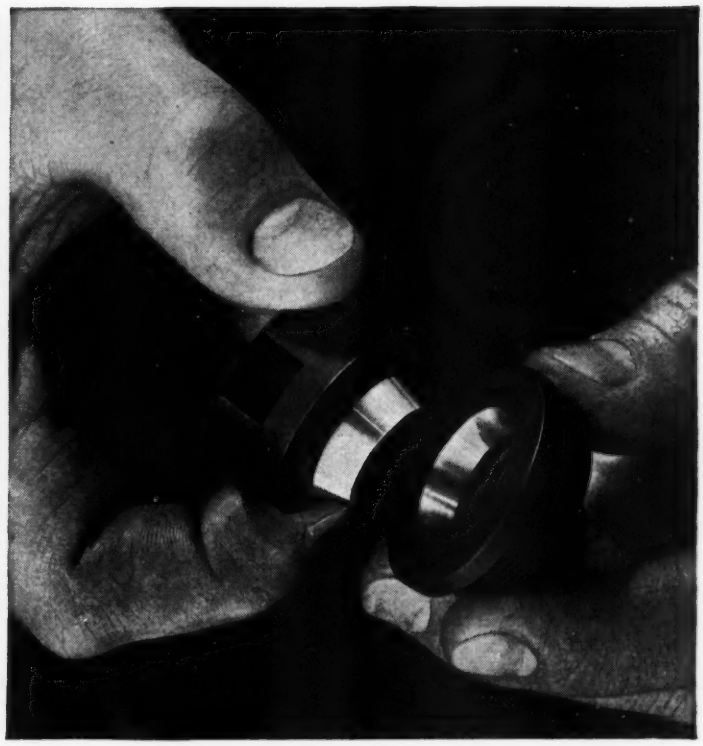
"Free engineering" is not the only type of ad that is objectionable to engineers in private practice. There are other, more subtle, advertising approaches that are harmful to the consultant. A number of ads are now showing the contractor in a role that is rightfully that of the consulting engineer. All too often we see the contractor featured in an ad as the man who selected this or that product. In one sense, the ad may be factually correct. The engineer may have written an open specification and reserved the right to approve or disapprove the particular brand chosen by the contractor on a price basis. Under these conditions it may be possible to say that the contractor "selected" the equipment. It is as though a mother were to say to her child, "You can have any kind of candy you want so long as you select chocolate, peppermint, or caramel, but after you have decided, I will tell you whether the one you picked is all right." We might say that the child "selected" the candy, but it was hardly a free selection.

Regardless of appearance, it is the consulting engineer who selects the equipment going into a project, and to give the credit to the contractor is twisting the facts. Ads of this type should be reported to the committee and they should see to it that advertisers are encouraged to give proper credit where credit is due.

On the positive side, more and more advertisers are featuring the consulting engineer and emphasizing his importance. This is a good thing, and the committee should devote as much of its work to writing letters of appreciation as to writing those of condemnation. Even the consumer product advertisers in the national general media magazines are taking advantage of the current trend toward glamorization of the engineer. A men's clothing manufacturer recently carried a full color ad in *The New Yorker* showing two well dressed consulting engineers looking over the construction of a new office building. Marlboro cigarettes carried an advertisement showing a tatooed but dignified looking engineer behind his desk. It seemed obvious in both of these ads, and in others recently published, that the engineers were consulting engineers — men in private practice.

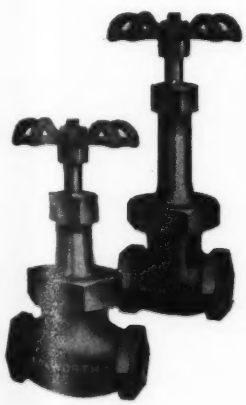
Good work on the part of the committee can mean millions of dollars worth of publicity for consulting engineers. To have the advertisers of the country behind you can accomplish more than any consulting engineer association could do with the limited budget at its disposal. We heartily endorse the plan, and we hope the committee will help us by keeping a particularly watchful eye on all of the advertisers in this magazine.

Walworth *the* real bargain!



EXTRA-LARGE STEMS with extra-long, extra-deep threads prolong valve life, protect against wear and distortion and provide tight positive shutoff. The surface of the stem is machined to a glass-like finish for minimum handwheel effort and to preserve the packing which results in fewer inspections and less maintenance. The top of the stem is tapered and squared to hold the handwheel securely.

TO REDUCE WIRE DRAWING to a minimum, certain types of bronze globe valves have stainless-steel plug-type seats and discs heat-treated to a nominal hardness of 500 Brinell, adding years to valve life even in severe services. These valves can be tightly closed on sand, grit or pipe scale without damage. Seats and discs are machined simultaneously, assuring perfect mating.



There is a Walworth Bronze Gate, Globe, Angle or Check Valve for every service. Walworth is continually developing new valve types and materials, including plastics, to keep pace with the growing variety and severity of services in modern industry. For full information, see your Walworth Distributor or write:
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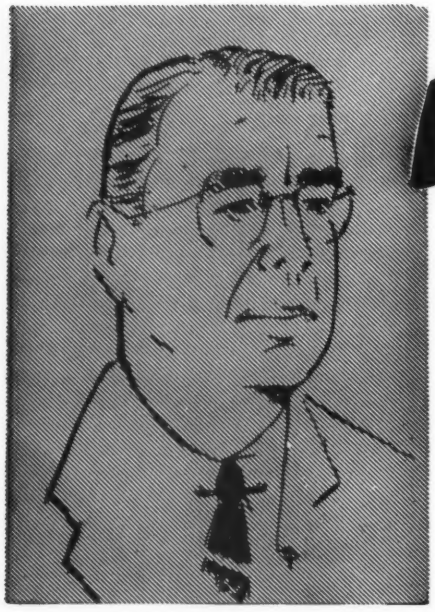

Economic News Notes

E. F. MacDonald
INDUSTRIAL ECONOMIST

PROSPERITY SPAWNED — The giant Road Show in Chicago and the adjunct conventions attracted an all-time-high attendance for any meetings anywhere. So great was the crowd that it spilled out of the city as far as 40 miles for food and shelter. Conventions and meetings, with those attending spending billions of tax-deductible dollars annually, have become a major industry in the economy.

RULER-STRAIGHT — Florida commissioned its first toll road at the end of January. The $62-million, 120-mile Sunshine State Parkway from Miami to Ft. Pierce is scheduled to be extended to the northern border of the State. A rather uncommon feature of this "bob-tail" section was that its $62 million cost was $12 million less than the $74 million raised by a bond issue to finance this construction.

ASSURED GROWTH? — The ARBA estimates that sufficient road-building equipment is available to implement a $5.8 billion annual highway construction program. Each $1 billion of construction beyond that mark will require $500 million of new machinery and equipment. To what extent has the stock market discounted such estimates in current quotations for shares of companies making road-building equipment?

FAST START — J. A. Volpe, interim Federal Highway Administrator, told ARBA's gigantic Chicago meeting that the new Federal highway program was moving faster than had been anticipated. Indicative of satisfactory progress was the fact "that in the first three weeks of 1957, a total of $150 million worth of projects was obligated for a rate of $2.6 billion annually if it keeps up."

RECOMMENDED READING — Pointing out that to a large extent engineers "backed into unionism," the study, "Unionization Among American Engineers," by the National Industrial Conference Board, goes on to explain that "To prevent themselves from being lumped in with production workers in National Labor Relations Board certification elections during the Wagner Act, engineers formed their own professional associations within companies . . . (many of which in time) took on the characteristics of unions." The study discusses reasons for engineer discontent, engineer unionization and the law, pay provisions in contracts, patent agreements, seniority provisions, and grievance procedures.

JOLLY ROGER — Charging that money is taken from taxpayers and used "to subsidize the pirating of engineers for Government defense contracts," Repres. Davis (D-Ga), chairman of a House Civil Service Subcommittee, has recommended to Defense Secretary Wilson that there be spelled out in detail the costs that should be allowed for recruiting engineers under defense contracts. In connection with the release of a Navy report on engineering recruitment costs for firms with and without defense contracts, Repres. Davis pointed out, "Even though the commercial-business firms had a greater volume of business, the firms with defense contracts spent over 10 times as much for recruiting."

WORLD'S LARGEST — The Prudential Insurance Co. will build a civic, business, and residential center in downtown Boston that will be the largest integrated center in the world. Spread over 31 acres, the Prudential Center will include a 50-story office building, a municipal convention hall with a seating capacity of 6000, one of the largest hotels in the city, garden and tower apartments, a "city-full" of stores and restaurants, and underground parking facilities for 5000 autos.

TEXAS STYLE — At the other end of the country, another center is under construction that merits the description "stupendous." A $125-million project is being built on 125 acres four miles from downtown Dallas. It will include four office buildings, a department store, a 1000-room hotel, a 1500-seat auditorium, a medical center, and 150 retail shops. The 3,000,000-plus sq. ft. of floor space and the mile of enclosed pedestrian malls will be air-conditioned. Heating and air-conditioning will be supplied by three gas turbines driving three 5000-kw generators.

GOOD CUSTOMER — A total of $2.5 billion will be spent by the chemical industry for new construction this year and next. The Manufacturing Chemists Assoc. breaks its estimate down by states, with Texas leading

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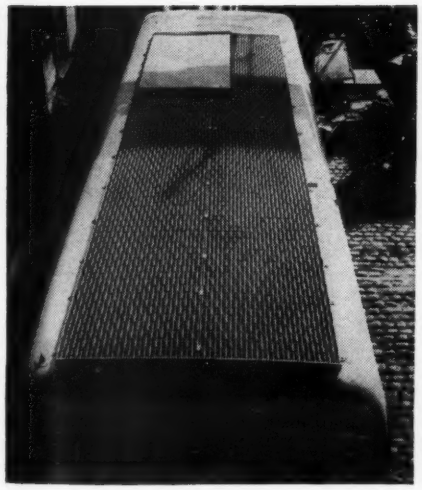
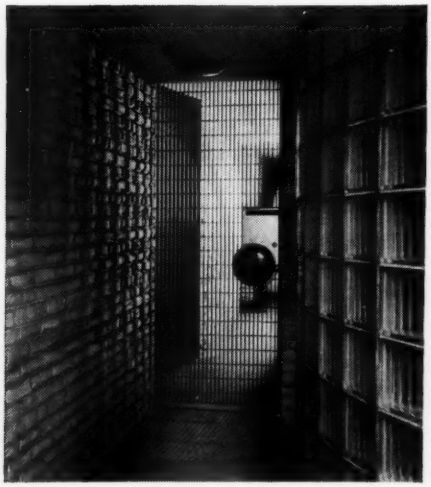
Functional beauty, low maintenance and child-proof fencing are a few of the advantages found in this *all aluminum*, pressure-locked grating.



Wherever this Color Television truck goes, whatever the assignment of the reporters who must mount its roof, BORDEN riveted *serra-crimp* grating will mean surerfooting —even in ice or snow.



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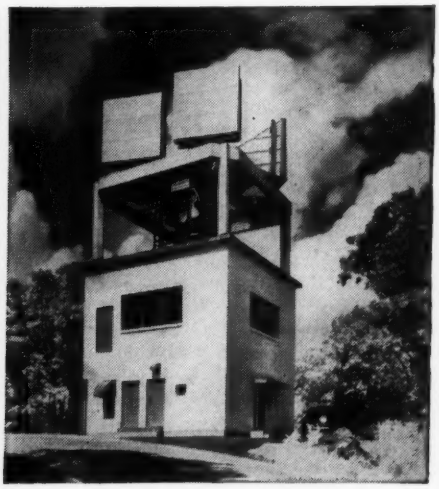

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the parade with projects slated to cost almost $640 million. The Association reported 354 capital-expansion projects completed during 1956, 278 under construction, and 128 that are "definitely planned" to be constructed.

RECRUITING EDEN? — The January 10, 1957 issue of the Wall Street Journal, by the way, had an article on the "growing stream of companies . . . setting up shop" in Florida because they feel that "attractions which tempt tourists to Florida also will entice scarce engineers." A few "buts" are mentioned.

ANOTHER ANSWER — Unless a larger proportion of students entering college elect engineering and science courses, the shortage of engineers and scientists will continue to increase until it hits a peak of 100,000 in 1967. A study by B. F. Goodrich points out also that another answer to the problem would be provided if more high school grads could be induced to continue their education since about "one-half of the top one-fifth . . . do not enter college."

ILLINOIS SCHOOLS — Gov. Stratton proposed in his inaugural address a $236-million bond issue to finance construction of facilities to relieve "our critical needs in the institutional and educational fields." In spelling out the great needs, he referred to "the decline in building during the war years, obsolescence and inadequacy of existing structures, the sharp rise in postwar construction costs, and an enormous expansion in the number of young people expecting to attend college . . . "

WE WUZ ROBBED — A survey of 93,000 engineers' salaries in 1956 discloses that engineers' salaries have not kept pace with wages of industrial workers. Had they matched the gains in the latter since 1939, the typical engineer's salary of $10,000 last year would have been $16,000. The study is available for $1.50 from EJC.

THROUGH THE TRANSIT—The Swiss plan to build the "highest building in the world"—a 1815-ft. tower with a 5-story cylindrical base and a 1300-ft steel and concrete cone . . . . A new edition of "Standard Plans for Highway Bridge Superstructure" by the Bureau of Public Roads is available from the Superintendent of Documents, Washington 25, D. C. . . . . A $12-million modernization and expansion program is under way at the Port of San Francisco . . . . A. O. Smith Corp., Milwaukee, has organized a subsidiary engineering consultant firm which will do business with other firms as well as with the parent company . . . . High school enrollments in Maryland in science and math courses are showing a definite uptrend . . . . New York State has allocated $469 million to the New York City area for urban arterial and interstate highway construction in the next five years . . . . Federal outlays for public works in fiscal 1958 will total about $6.3 billion, 28% more than the current year's total . . . . President Hood of U.S. Steel said that the $775 million in unexpended balances at the close of 1956 will be spent "as rapidly as we can" on assigned capital expansion projects . . . . highway Highlights states that Federal funds for aiding highway construction were first authorized in 1806 and totaled $30,000.

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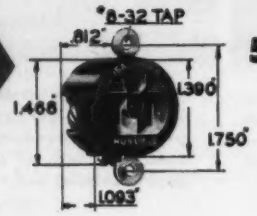
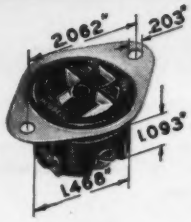
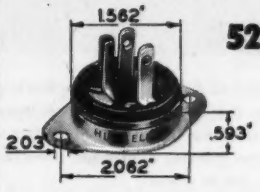
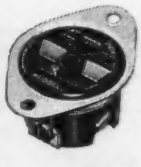
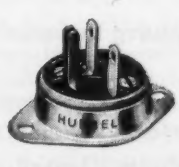
Parallel Slot 15 AMP 125 VOLT	 5258	 5256	 5288
Tandem Slot 15 AMP 250 VOLT	5658	 5656	 5668
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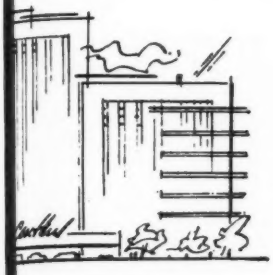

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Bridgeport, Conn.	Bridgeport Hospital	Hill & Harrigan	Mitchell & Bailey	Harold Jope
Knoxville, Tenn.	Mercy Hall Hospital	Harry F. Wilson, Engr.	John F. Whelahan Co.	J. Scruggs
Shreveport, La.	Schumpert Hospital	Neil Somdal & Assoc.	Brown & Olds	H. Cunningham
Topeka, Kans.	V. A. Hospital	U.S. Corp. of Engrs.	Farwell Co.	H. Cunningham
Las Vegas, Nev.	S. Nev. Memorial Hos.	W. Zick, H. Sharp, Archs.	Grinnell Co.	Nic Nicodemus
El Paso, Texas	Mimbres Memorial Hos.	Schaefer, Merrell Assoc.	R. S. Palmer, Inc.	Wm. L. Massey
Bloomington, Ind.	Medical Science Bldg., Ind. U. Med. Center	Ammerman, Davis & Stout, Indpls.	Hayes Bros.	Don Davisson
Queens, N.Y.	Elmhurst Gen. Hos.	York & Sawyer, Arch. Feilheimer & Sawyer, Eng.	Joseph F. Egan	Sam Burleigh
	Hotels-Apartments			
St. Louis, Mo.	Pruitt Housing Jobs (5 Projects)	J. D. Falvey, Cons. Engr.	Gartland Plbg.-Fischer Pig.-Tobin Bros. Plbg.	Ken Williams
Hartford, Conn.	Shelbourne Apts.	J. P. Negnos, Assoc. Engr.	McRory & Marren	Harold Jope
Surfside, Fla.	Florida Shores Hotel	Sherman Assoc. Arch.-Engr.	Town & Beach Plbg.	J. Scruggs
Arlington, Va.	Pentagon Plaza Apts.	Gen. Engrg. Assocs.	Harry E. Nau & Co.	George Fee
Ft. Wayne, Ind.	Van Orman N'crest Motel	A. M. Strauss, Inc.	Hipskind P&H	Ted Johnson
Beverly Hills, Calif.	Beverly Hilton Hotel	Welton Becket & Assoc.	Scott Co.	Lang Pratt
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Minneapolis, Minn.	Federal Reserve Bank	Richard W. Evans	Mooneys	Art Narverud
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El Paso, Texas	El Paso City-County Bldg.	Monroe, Licht, Higgins	R. E. McKee	Wm. L. Massey
Tulsa, Okla.	S.W. Bell Tel. Bldg.	Carnahan & Thompson	Carl Moore Co.	F. Merryman
Indianapolis, Ind.	Ind. Nat'l Bank Bldg.	Bevington, Taggart, Fowler	Freyn Bros.	Don Davisson
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New York City	Socony Mobile Bldg.	Harrison, Abramovitz, Ar. Jaros Baum & Bolles, Engrs.	Eugene Duklawer, Inc.	Sam Burleigh
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The Legal Aspect

MELVIN NORD, P.E.
Consultant in Legal and Technical Problems
Patent Attorney

Atomic Energy Law (Restricted Data)

IN ORDER TO SHOW how the Atomic Energy Act does (or does not) work out in practice, let us assume a hypothetical case for the purpose of illustration, and carry it through to completion.

Let us assume that the A Corporation has been engaging in activities in the atomic energy field for some time, and has developed (on paper) a novel type of power reactor. The company has had preliminary negotiations with private companies in Australia and India, companies that are interested in purchasing a complete power reactor, after a full scale prototype has been successfully operated in the United States. It will be assumed that further financing will be needed for the construction of the prototype, and that in view of its high cost it will be necessary to operate it permanently in the United States to produce power for sale to a public or private utility company.

Born Secret

Since we will need additional technical staff for the detailed design, construction, testing, and operation of the prototype, these men will need security clearance in order to permit them to make use of restricted data.

The Atomic Energy Act (Sec. 11r) defines restricted data as follows: "The term 'Restricted Data' means all data concerning (1) design, manufacture, or utilization of atomic weapons; (2) the production of special nuclear material; or (3) the use of special nuclear material in the production of energy, but shall not include data declassified or removed from the Restricted Data category pursuant to section 142."

While this section sounds "harmonious" enough, it is actually extremely "syncopated," i.e. out of step with the usual definition of restricted data. In all other fields, data that the government develops and desires to keep from the public explicitly is marked restricted (or confidential, secret, or top secret). Any other information of course is not restricted. But in dealing with atomic energy activities, everything is reversed. All information concerning atomic energy (at least relating to reactors) is "born secret" and remains so forever, unless and until the government declassifies it. The fact that the government hasn't developed it doesn't prevent the data from being restricted — nor does the fact that the government doesn't even know of its existence.

Penalties for Transmitting Data

Thus, if we have produced new information concerning power reactors, it is born restricted. And we had better not disclose it, on our own motion, to our Australian or Indian customers. There are some extremely stiff penalties for overlooking this little detail. For example, Sec. 224 of the Atomic Energy Act reads: "Whoever, lawfully or unlawfully, having possession of, access to, control over, or being entrusted with any . . . information involving or incorporating Restricted Data—communicates, transmits, or discloses the same to any individual or person, . . . with intent to secure an advantage to any foreign nation, . . . shall be punished by death or imprisonment for life . . . " Thus, it seems pretty clear that no one will make this mistake twice. We shall see later how it will be possible for us to transmit information to our foreign customers.

Reporting Requirement

If the company develops some new information, not only is it born secret, and not only is it criminal to disclose it to a foreign customer, but it can't be kept completely secret either. Sec. 151 (c) of the Atomic Energy Act says: "Any person who has

Continued on page 43

made or hereafter makes any invention or discovery useful in the production or utilization of special nuclear material or atomic energy . . . shall file with the (Atomic Energy) Commission a report containing a complete description thereof unless such invention or discovery is described in an application for a patent . . . within the time required for the filing of such report. The report . . . shall be filed on or before . . . the ninetieth day after such person first discovers or first has reason to believe that such invention or discovery is useful in such production or utilization."

Unintentional Violation

Since not every discovery is patentable, the reporting provision may be applicable to and may be very important in many cases. The general attitude of the Act is that if you are smart enough to make a discovery, you must be smart enough to realize its atomic energy implications. For if you fail to realize this, you are nevertheless violating the Act. Such faith in scientists and engineers is touching but misplaced. And any scientist or engineer who happens to overlook this quirk of the law will have to atone for it by paying a fine of up to $5000 or by imprisonment for up to two years, or both (Sec. 223 of the Atomic Energy Act). Of course, if this crime is committed "with intent to secure an advantage to any foreign nation," the fine is raised to $20,000 and the term of imprisonment to 20 years. (This is assuming he never gets around actually to communicating it to the foreign customer.) Of course, if a scientist or engineer makes such a discovery without realizing there is anything new about it, he will not know it needs to be reported, but that's his tough luck.

Fortunately, most scientists and engineers do not know anything about these laws. Otherwise, the chances of our hiring anv of them on this project would be nil. Again, ignorance is bliss.

Can Atlas solve your
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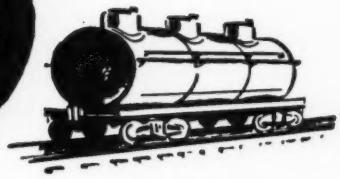
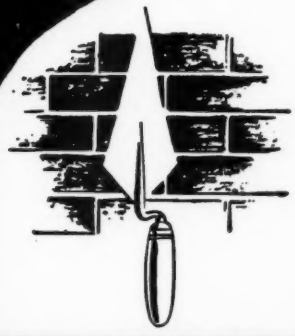


. . . WITH HIGHEST QUALITY MATERIALS?



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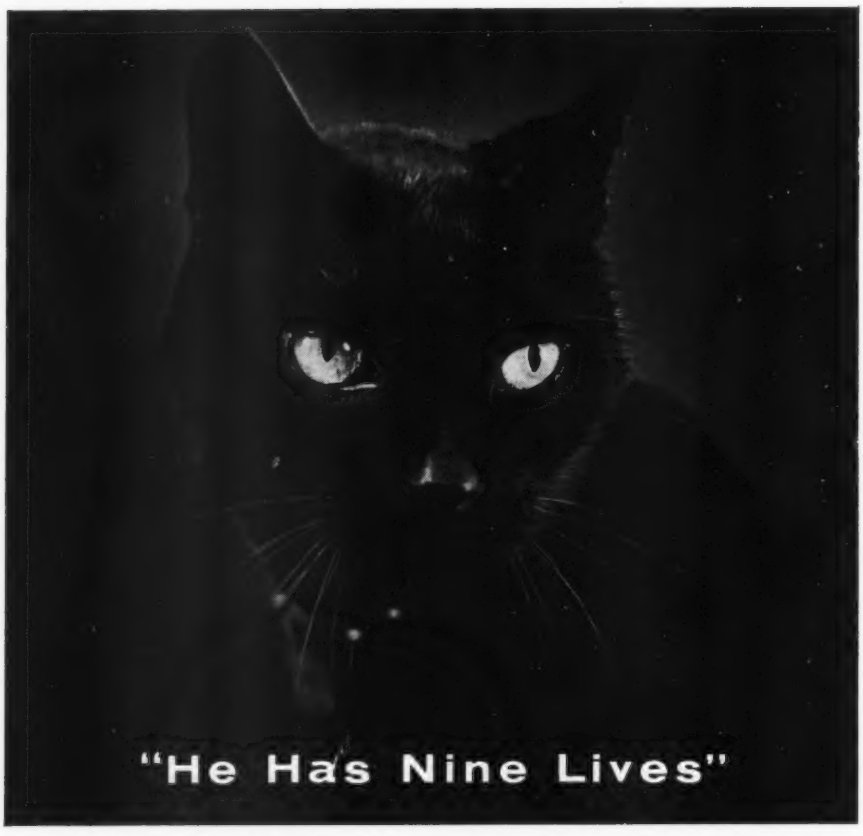

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These tests are substantiated by actual installations. They now establish the Aerotec 5 RWS collector with white iron tubes as the ultimate in long life and sustained high efficiency in the field of mechanical collection.

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THE AEROTEC CORPORATION

Greenwich, Conn.

It might be added that if we attempt to play it safe by filing patent applications on practically everything, we are only asking to be fined up to $2500, with no jail term (Section 227, Atomic Energy Act). The reason for this is that we are likely to overlook the fact that the patent attorney we select may not be cleared for restricted data, and probably knows little about the Atomic Energy Act. If so, we have disclosed restricted data to a person who is not authorized to receive it. A happy thought in this connection, however, is that the attorney is equally guilty and will have to pay the same fine. On the other hand, if we repeat this offense on a number of occasions before we realize what we are doing, the fine may mount up to such a high figure that life imprisonment could look pretty good.

Clearance

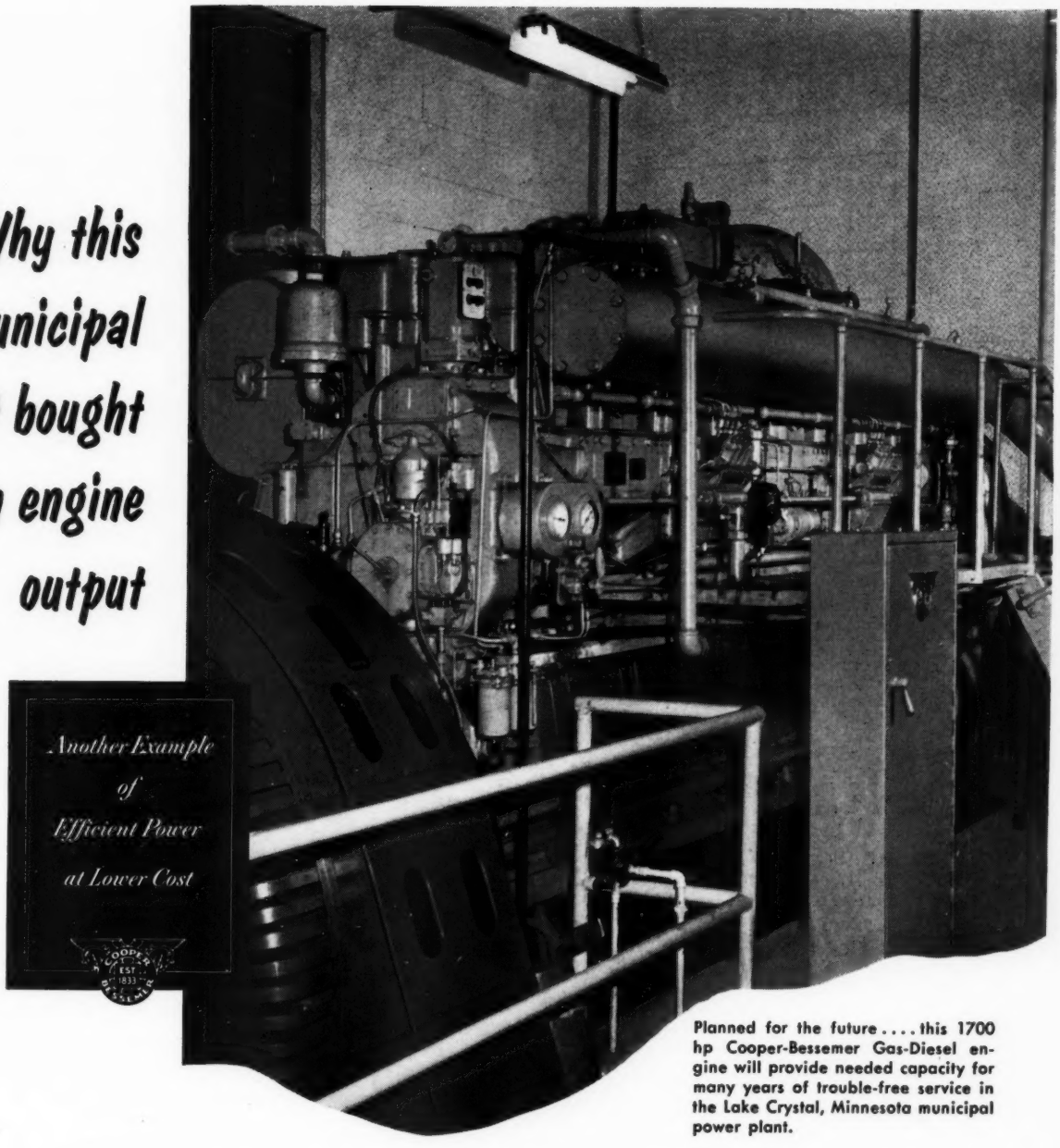
Assuming we can get some new staff members, our very first task will be to make absolutely sure that they are cleared for receiving such information and that they don't spread it around.

Sec. 161i of the Atomic Energy Act of 1954 authorizes the Atomic Energy Commission to prescribe regulations to protect restricted data, and this has been done by the AEC and published as Part 25 of the AEC Regulations (published Feb. 4, 1956 in the Federal Register).

Access Permits

According to the Note appended to Rule 25.11, "Where an individual desires access to Restricted Data for use in the performance of his duties as an employee, the application for an access permit should be filed by his employer." It is probably safe to assume that the corporation will already have such an access permit, in view of the work it has done already. But as the Note appended to Rule 25.21 states, "An access permit is not a security clearance. It does not authorize any individual not

Why this small municipal plant bought extra engine output



Planned for the future . . . . this 1700 hp Cooper-Bessemer Gas-Diesel engine will provide needed capacity for many years of trouble-free service in the Lake Crystal, Minnesota municipal power plant.

• Lake Crystal, Minnesota carefully studied the matter, installed a high output Cooper-Bessemer engine, and they're far from sorry. This small community enjoys substantial savings from a 1200 kw. . . . 1700 hp. . . . 155 bmep Gas-Diesel engine.

The engine, a supercharged Cooper-Bessemer JS, boasts an enviable "around the clock" operational record with excellent fuel economy maintained under heavy *or* light loads. With the installation of this new unit, there's no further need for riding an engine at costly, inefficient loading in anticipation of sudden heavy increases.

Although oversized for present needs, this 8 cylinder Cooper-Bessemer will more than justify its original cost. Dependable, economical power will be available for many future years. And as Lake Crystal power demands grow . . . this JS will easily handle the increased load. No need for costly plant expansions. No new engines to buy.

Impressive month by month operating cost records of Lake Crystal municipal are available upon request. Write The Cooper-Bessemer Corporation, Mount Vernon, Ohio.

MOUNT VERNON, OHIO

COOPER-BESSEMER

GROVE CITY, PENNA.

New York City • Seattle, Wash. • Chicago, Ill. • Houston, Dallas, Greggton, Pampa and Odessa, Texas • Washington, D. C. Shreveport, La. • San Francisco, Los Angeles, Calif. • St. Louis, Mo. • Gloucester, Mass. • New Orleans, La. • Tulsa, Okla. Caracas, Venezuela • COOPER-BESSEMER OF CANADA, LTD., Edmonton and Calgary, Alberta, Canada.

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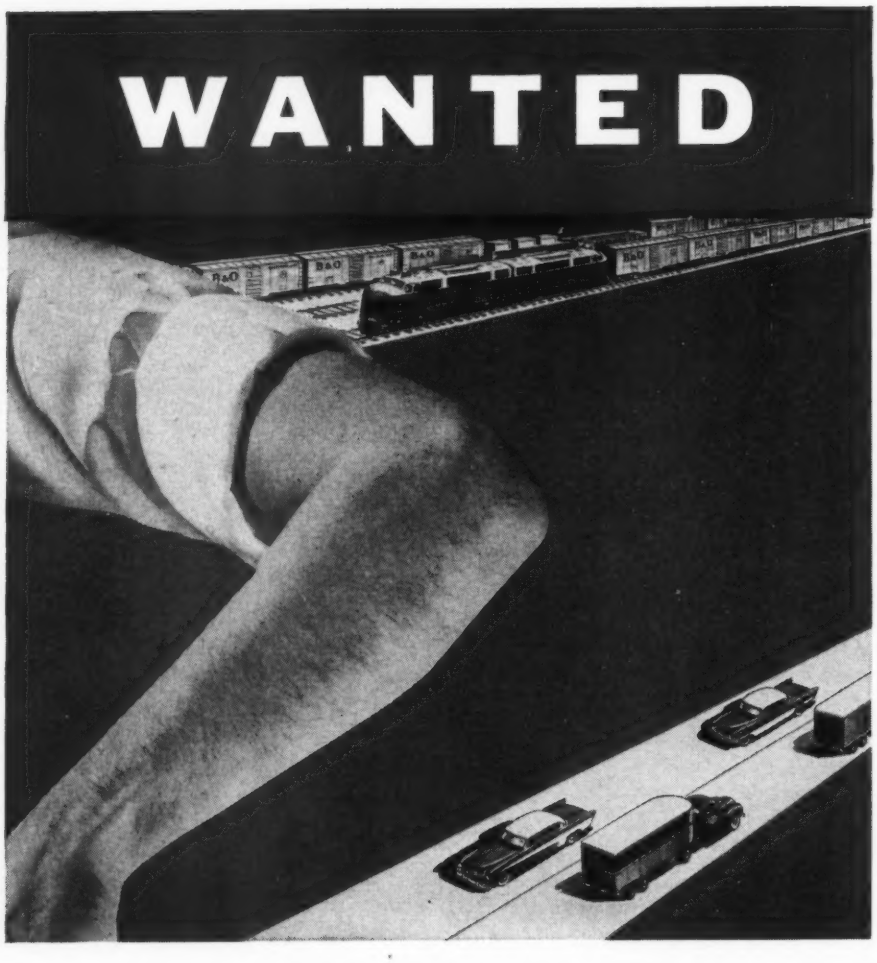


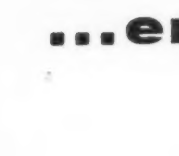
...enough Elbow Room

Everybody benefits when highway location allows adequate space for new industrial development between railroads and public roads. The highway is a major artery, usually difficult or impossible to cross with spur trackage.

The *right kind* of planning by community and highway authorities makes *sure* that: (1) Areas with reasonable prospect of industrial development are protected by modern zoning. (2) Highway authorities plan new construction at *sufficient distance* from rail lines—*200 to 1,000 yards is realistic.*

Orderly construction of grade separations and needed approaches is possible when industrial zoning and highway planning go hand in hand. Then, properties between highway and railroad become more valuable as potential plant sites, and are *assured* the best choice of efficient transportation. The community benefits by NEW jobs and NEW sources of tax revenue—and *every citizen* benefits!

SPECIAL STUDY
"Look where a site is production-right"
ON REQUEST FROM
B&O RAILROAD
BALTIMORE 1, MD.



B&O'S PLANT SITE MEN ARE LOCATED AT:
BALTIMORE 1—LExington 9-0400
NEW YORK 4—Digby 4-1600 CINCINNATI 2—DUnbar 1-2900
PITTSBURGH 22—COurt 1-6220 CHICAGO 7—WAbash 2-2211

LINKING 13 GREAT STATES WITH THE NATION B&O

BALTIMORE & OHIO RAILOAD
Constantly *doing things*—**better!**

having an appropriate AEC security clearance to receive Restricted Data."

In order to obtain individual clearances for new staff members of the company, it will be necessary under Rule 25.24 to request such personnel clearances from the AEC. The Atomic Energy Commission has published, in the Feb. 2, 1956 issue of the Federal Register, Part 95 of its Regulations covering the necessary procedures for obtaining individual clearances.

Security Education

Rule 95.5 requires the Company to provide security education for such employees and to inform the AEC of the procedures followed. Rules 95.21 and following provide for physical security of documents, including storage of documents when not in use, security areas, armed guards, etc. Presumably these will all have been taken care of earlier when obtaining the original access permit.

Rule 95.31 authorizes access to restricted data for employees having L clearances (for confidential material) or Q clearances (for secret material). The AEC will be requested to grant the necessary clearances under Rule 25.24.

Next Month — Financing

Thus, sooner or later we will have our staff, and will be ready to put them to work — provided we can find a way to finance the project. Of this, more next month.

Expert Witness Reprint

Robin Beach's five articles on "The Engineer as an Expert Witness" are available in a 16-page reprint for $1.00. Please write to: Reader Service Dept., CONSULTING ENGINEER 227 Wayne St., St. Joseph, Mich.

business"

Mr. Henry E. Widdell,

President of Arthur G. McKee & Company of Cleveland says:

"By employing an engineering and construction company, you take a short-term lease on a whole company-full of carefully selected, experienced, diversified engineers. Their function is to give you reliable, imaginative help in working out more efficient methods . . . to apply broad knowledge and practical experience in choosing manufacturers' products to implement each process. They help keep growing pains out of a growing business."

Belt Conveyors have been long recognized as the most practical and economical means of moving large quantities of bulk material over great distances.

This view shows the loading end of a Jeffrey Belt Conveyor—note series of rubber-cushion idlers designed to protect belt from impact of heavy pieces.

Handling taconite is a tough assignment, because it's highly abrasive. So Jeffrey Belt Idlers were a logical choice for the 94 belt conveyors (2700 feet of them) serving this pelletizing plant. All bearings are protected against the entry of dirt by an effective, double labyrinth grease seal. Ends of rolls are shaped to deflect materials away from these seals.

Jeffrey Idlers offer maximum efficiency, dependability and economy in belt operation. Oversize roller bearings reduce power requirements and give a factor of safety far in excess of any overloading to be expected. Positive roll alignment assures continuous full capacity operation.

It pays to team up with a top flight engineer-constructor and to specify Jeffrey feeders, conveyors, elevators, magnetic separators, primary and secondary crushers, chains, power transmission machinery, and related equipment.

THE JEFFREY MANUFACTURING COMPANY
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JEFFREY

CONVEYING • PROCESSING • MINING EQUIPMENT...TRANSMISSION MACHINERY...CONTRACT MANUFACTURING

ATOMS IN ACTION

BOTH the Anderson-Price indemnification bill and the Gore-Holifield reactor acceleration bill have been reintroduced in the House and Senate. The Anderson-Price bill has been revised to incorporate amendments agreed upon by the Joint Congressional Atomic Energy Committee last session. The acceleration bill was reintroduced as reported out by the Joint Committee without any of the amendments proposed by Rep. W. Sterling Cole last session. Both have been referred again to the Joint Committee. AEC and the insurance industry also have been working together for some time on a draft of legislation to provide supplemental government insurance.

THE PRESIDENT'S budget for the fiscal year beginning July 1, which requests $2,578 million for atomic energy purposes, includes money to provide training centers in the U.S. and abroad, equipment grants, and other technical assistance to help other nations develop their own atomic energy programs. Four nations have already accepted the U.S. offer to share the cost of building research reactors. A number of nations have indicated interest in buying power reactors in the U.S., and the Export-Import Bank has offered to consider applications for loans to finance such purchases.

CHARLES J. HAUGH, vice president of the Travelers Indemnity Co., has stated that the Nuclear Liability Insurance Association, the syndicate of 135 stock companies, will be able to write a $50 million liability insurance policy on any given reactor. With participation of the mutual companies, he said, there probobly will be a total of at least $60 million of liability insurance for each reactor operator, together with his contractors and suppliers. The Nuclear Energy Property Insurance Association, the syndicate organized to handle physical damage coverage for the insured's own property, also will be able to meet its goal of $50 million. With mutual companies this should mean at least $60 million coverage available.

AN OPINION poll of the American atomic industry, conducted by Atomic Industrial Forum, Inc., gave lack of economic incentive, inadequate insurance protection, and secrecy policy of the government as the three main factors limiting the development of atomic energy for peaceful purposes. Of the 167 Forum member organizations participating, 43 percent were manufacturers, 14 percent construction-engineering firms, 13 percent utility companies. The remaining 30 percent included consulting firms, financial institutions, insurance companies, labor, law firms, mining companies, laboratories, and universities.

PIONEER SERVICE & Engineering Co. will act as architect-engineer on a 60,000-kw atomic power plant planned by ten Midwest electric utility companies. Subject to approval by AEC, the plant would be located on the system of Northern States Power Co., one of the participating utilities. Negotiations are underway with Allis-Chalmers to act as prime contractor for a controlled re-circulation boiling water reactor.

GREECE, which plans a major atomic energy research program, has awarded a contract to AMF Atomics, Inc. for design and construction of a 1000-kw swimming pool research reactor for the national atomic energy laboratory to be located near Athens. Babcock & Wilcox Co. will supply the fuel element for the reactor, which is scheduled to be in operation in the spring of 1958.

WESTINGHOUSE electric scientists have developed a new means of photographing neutrons being shot through crystaline materials to determine their atomic structure. Although neutron "bullets" have been used for this purpose for some time, it has been difficult to get a satisfactory picture of the diffracted neutrons. The new technique shortens exposure time of the film as much as 100 times and produces a clearer picture. The technique is expected to expedite analysis of crystals of magnetic materials and organic compounds difficult to identify by means of x-rays.

CLOSED CIRCUIT television will be used at the Hanford atomic plant to patrol the rear face of the atomic reactor. Designed to move automatically along a monorail near the wall of the reactor, the camera will transmit a picture of reactor components to an operator seated at a console behind thick radiation shielding. It is expected to speed maintenance jobs by making it possible to pinpoint trouble spots before special work crews are sent into the area. This is the first attempt to use TV at an actual reactor site.

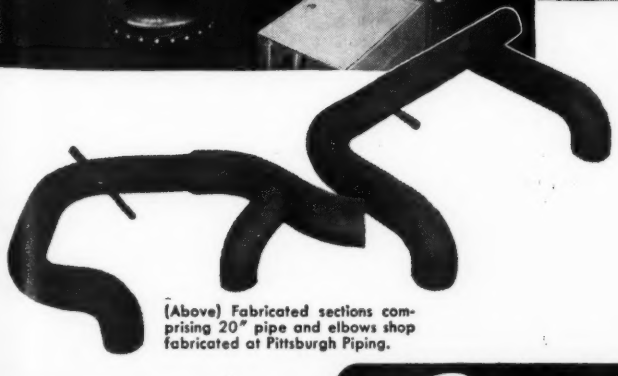
ALCO PRODUCTS, INC. has signed an agreement with Humphreys and Glasgow Ltd., of Great Britain, a firm of engineer-constructors, for the sale of small nuclear power plants outside of the North American continent. A 10,000-kw pressurized water reactor of the type to be sold is expected to produce power at a cost somewhat more than an oil or coal-fired station of similar size, when installed in Great Britain. H&G expect to sell the plants chiefly to communities and industrial concerns where conventional power production cost is high.

RESEARCH at Pittsburgh Piping

Stress analysis of model of power piping system at Pittsburgh Piping accurately predicts physical reactions of full size system in service.

another
P. P. & E. service
which contributes to
Improved
HIGH-TEMPERATURE
HIGH-PRESSURE
PIPING

(Below) Metallographic examination of piping materials and weld samples reveals changes which occur in a metal's crystalline structure due to operating conditions and fabricating procedures.



(Above) Fabricated sections comprising 20" pipe and elbows shop fabricated at Pittsburgh Piping.

Our technical staff constantly explores the mechanical and metallurgical aspects of power and process piping. For example, stress analysis by model testing is used to predict accurately the physical reactions of high-temperature, high-pressure piping in service. Extensive investigations are conducted on the metallurgical effects of operating conditions and fabricating procedures on piping materials. This knowledge pays off in the sound piping systems we fabricate and erect for central stations and nuclear power installations.

PRODUCTS AND SERVICES

Carbon Steel Piping	Forged Piping Materials
Cast Iron Fittings	Headers
Cast Steel Fittings	Manifolds
Chrome-Moly Piping	Pipe Bends
Copper Piping	Stainless Steel Piping
Corrugated Piping	Van Stoning
Creased Bends	Welded Assemblies
Expansion Bends	Welded Stainless Steel Tubing
Flanges	Welding Fittings

PP-24

Pittsburgh Piping
AND EQUIPMENT COMPANY
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CANADA: CANADIAN PITTSBURGH PIPING, LTD.
835 BEACH ROAD—HAMILTON, ONTARIO

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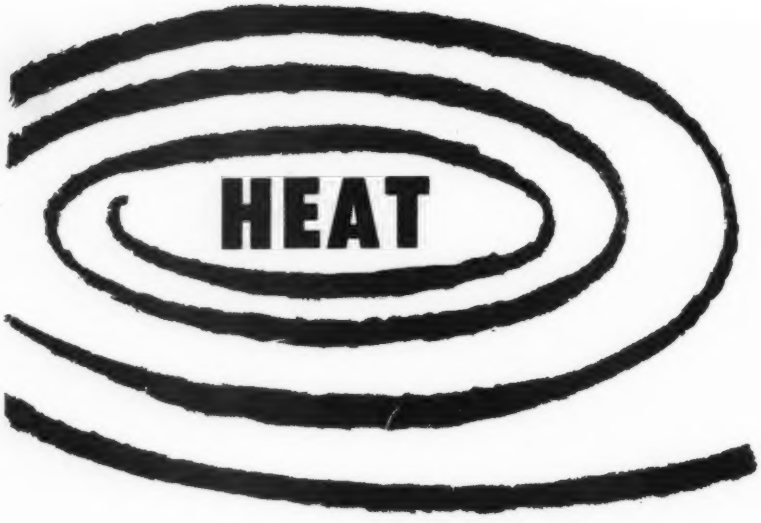
Boston	10 High Street
Chicago	Peoples Gas Building
Cleveland	Public Square Building
Hollywood	1828 North Alexandria Ave.
New Orleans	P. O. Box 74
New York	Woolworth Building
Syracuse	113 So. Salina Street
Toronto	68 Yonge Street



. . . may be the "trouble" with your electrical system

Are you troubled with nuisance power interruptions, insufficient branch circuit capacity, motor burnouts and the accompanying costly production delays? You will probably find that *heat* affecting your protective electrical equipment is the heart of your trouble.

You can eliminate heat considerations, however, simply by replacing with HEINEMANN Circuit Breakers.

HEINEMANN Circuit Breakers do not employ thermal elements or heaters of any type. Thus, their current carrying capacity and all set tripping points are completely independent of ambient temperature . . . unaffected even by nearby furnaces, steam pipes or cold drafts. HEINEMANN Circuit Breakers do not require de-rating. With HEINEMANN, 20 amperes means 20 amperes of usable capacity without needless tripping.

HEINEMANN Circuit Breakers operate on a hydraulic-magnetic principle. They provide inverse time delay to allow starting inrush or harmless, temporary overloads . . . yet they provide the fastest circuit interruption available on large overloads or short circuits.

GET THE COMPLETE FACTS: Send for your copy of "WHAT YOU SHOULD KNOW ABOUT CIRCUIT BREAKERS". Ask for Manual 101.

HEINEMANN ELECTRIC COMPANY
157 Plum Street • Trenton 2, New Jersey

HEINEMANN Circuit breakers

TESTS CARRIED OUT in the KEWB (Kinetic Experiment for Water Boiler Reactors) program that North American Aviation is conducting for AEC have confirmed the theory that water boiler research reactors will shut off automatically when abnormal operating conditions occur. This characteristic is due to formation of gas bubbles in the reactor fuel as the temperature increases. Tests were run on a 50-kw water boiler.

THE NEW COBALT-60 gamma irradiation unit, available for irradiating materials on a service basis at Oak Ridge National Laboratory, can irradiate samples in air rather than under water as is the case with most gamma irradiation units now in operation. The unit will have a gamma ray output in excess of 1.1 million roentgens per hour and will utilize the 85,000 to 300,000 curies of radioactive cobalt usually in storage at the Laboratory awaiting shipment to isotope users.

GIFFELS & VALLET, Inc. will act as architect-engineer on the fuel processing and alloy fabrication facility to be built at Chalk River, Canada. Atomic Energy of Canada Ltd., the Canadian government's research and development company, will operate the facility.

THE MITSUBISHI Heavy Industries Co., of Japan, says it is designing a submersible oil tanker using nuclear propulsion. The ship is to weigh 30,000 tons, cruise at 22 knots, and have an over-all length of 540 feet.

THE POSSIBILITY of building nuclear power plants on the western Cape and in other areas of the country remote from coal fields will be investigated by a commission appointed by the government of South Africa to study applications of nuclear power.

AEC IS SEEKING proposals from engineering firms for design of a liquid hydrogen plant to be located near Henderson, Nev. The plant will be used for what AEC called "a proposed non-weapon experimental program now under consideration."

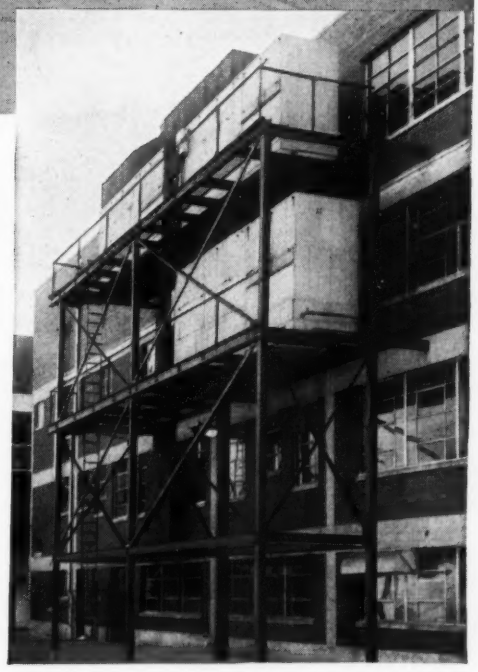
ARGONNE National Laboratory's experimental boiling water reactor went into continuous full power operation at formal dedication ceremonies in February. The reactor will supply 5000 kw of electricity from 20,000 kw of heat, all of which will be used by the Laboratory. Sargent & Lundy were architect-engineers on the project.

Racing enthusiasts watch in cool comfort from *Airtemp air conditioned* clubhouse of Sportsman's Park track in suburban Chicago. *Consulting Engineers, Contractors:* Acme Temperature Control, Chicago.

Airtemp The SURE WINNER at Sportsman's Park...

Cooling with minimum installation time and cost is a sure thing —with Airtemp "packaged" air conditioning. It can be used with or without ductwork...to cool either single areas, or multi-story complete buildings, like the Sportsman's Park clubhouse.

Another example of how Airtemp's *complete* line—286 models, biggest selection of any manufacturer—helps American business and industry solve cooling problems with models specifically suited to particular requirements—at *standard-model cost!* And all engineered by Chrysler.



Outside-mounted Airtemp units—1 60-ton Model 2660, and 2 40-ton Models 2640—*silently* and *unseen* cool the 160,000 cubic foot clubhouse. Evaporative condensers totally eliminate need for cooling towers, drastically reducing installation and maintenance expense.

Airtemp CONSTRUCTION
DIVISION OF CHRYSLER CORPORATION

PHONE your nearby Airtemp contractor. He's in the Yellow Pages. Or—write to Airtemp Construction Division, Chrysler Corporation, Dayton 1, Ohio.

A CHRYSLER DIVISION SPECIALIZING IN AIR CONDITIONING FOR EVERY HOME AND BUSINESS NEED

Models for panel or wall mounting

This Reliance Gage, completely hydrostatic, assures safe, accurate reading of your boiler water levels

Here is easy natural reading (like conventional water gages) with perfect measurement and constant dependability. Twenty years on the market, and still increasing in use, here and abroad.

Simple as A-B-C, EYE-HYE indicates water level clearly by illuminated green fluid. Newly styled face plate gives wider angle of vision. And for extra safety, optional equipment adds auxiliary light signals and/or vibratory horns, reaching operators anywhere.

EYE-HYE serves main boilers — any pressure — and various power plant tanks and vessels in out-of-the-way places. Two EYE-HYEs are now acceptable under Boiler Code Case No. 1155 — eliminate maintenance of extra gage glass.

Rugged construction; no mechanical working parts; no adjustments on location; easy to maintain. Write for Bulletin CO today.

The Reliance Gauge Column Company • 5902 Carnegie Avenue • Cleveland 3, Ohio

Reliance EYE-HYE
Remote Reading Gage
All-hydrostatic • Reads like a tubular glass gage

This is the first reactor of the five in AEC's original five-year power reactor development program to be completed and to generate electricity.

THE NAUTILUS will be refueled for the first time this spring, after having traveled more than 55,000 miles since her launching in 1955. The old uranium core will be sent to Arco, Idaho, for examination and to reclaim unused uranium.

THE FOOD AND DRUG Administration has started a continuous survey of radioactivity of selected foods produced in this country. They will first determine naturally occurring background radioactivity in staple foods from different areas, and then monitor these foods for any changes in radioactivity which might be caused by weapons testing and other applications of atomic energy.

POLYTECHNIC INSTITUTE of Brooklyn will offer a course on metallurgy of nuclear power reactor materials in its spring semester for graduate students and professionals working in the field.

SOMETHING NEW has been added at Columbia University—a faculty Council for Atomic Age Studies. Purpose is to make the University a center for the study of problems facing society as a result of the development of atomic energy. Represented on the Council are the fields of physics, engineering, medicine, international relations, journalism, business, philosophy, and law.

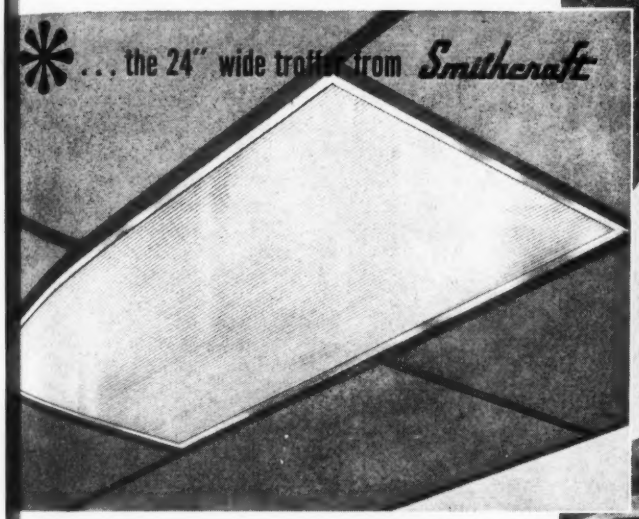
KAISER ENGINEERS will design and build the $3 million food irradiation reactor for the Army's Ionizing Radiation Center, at Stockton, Calif. American Radiator & Standard Sanitary Co. will design the core under subcontract to Kaiser.

TWO MAJOR CONFERENCES on atomic energy applications are scheduled for March. March 11-15, the 1957 Nuclear Congress, coordinated by Engineers Joint Council, and the International Atomic Exposition, will be held at Philadelphia's Convention Hall. On March 27-29, the Glenn L. Martin Co. and the Navy Department's Office of Naval Research will co-sponsor a Colloquium on Radiation Effects on Materials on the campus of Johns Hopkins Univ., Baltimore.

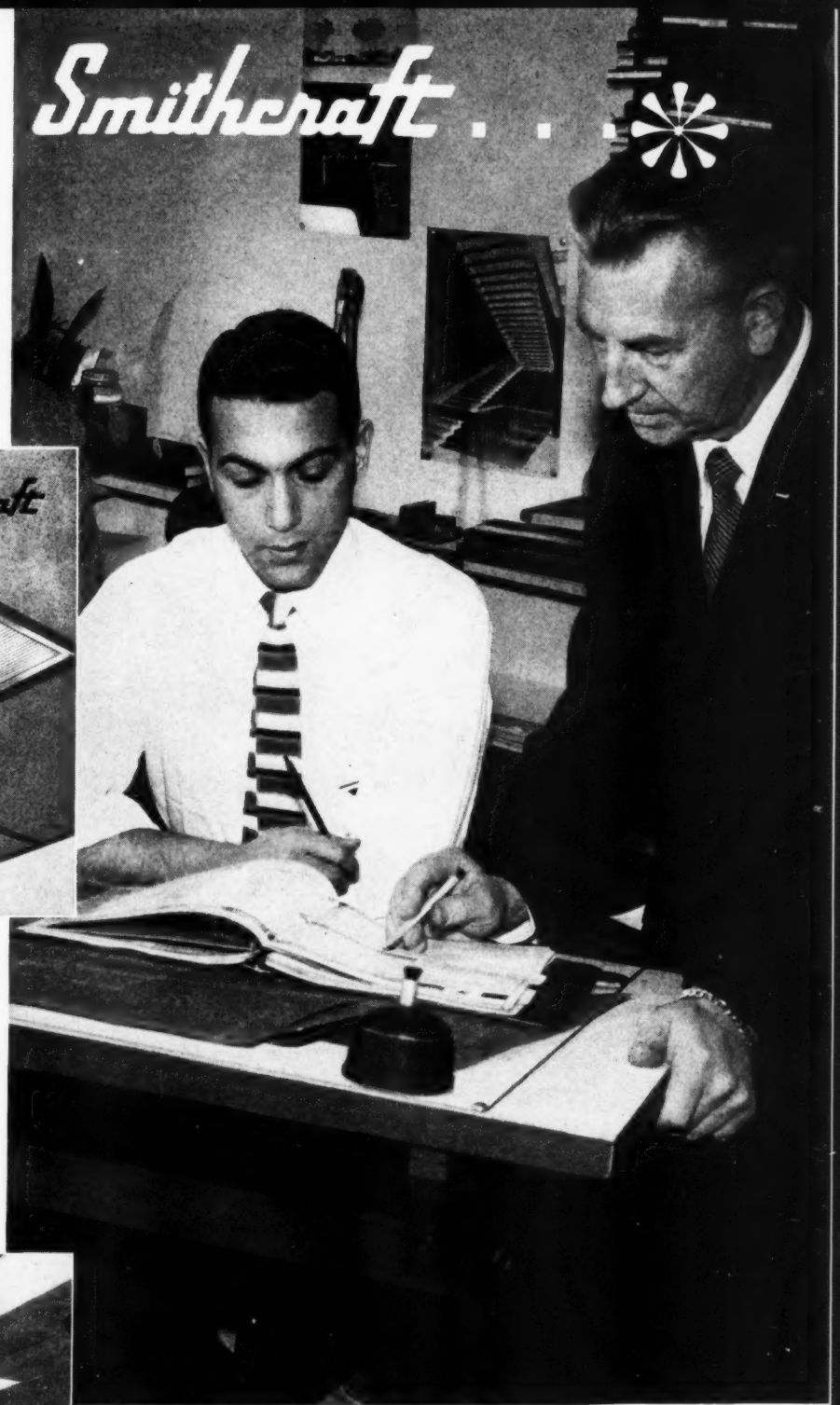
A MINIATURE nuclear powered battery capable of delivering continuous electrical power for at least five years has been developed by

the man from Smithcraft . . .

When you put his knowledge of lighting to work for you, your ideas turn into reality. His experience enables him to translate architectural concepts into effective lighting results by applying the flexibility of Smithcraft's line of lighting units. Call him in to consult with you or your lighting engineers on any job on your boards . . . you'll find he knows blueprints and budgets as well as he knows lighting!



New features to aid in your ceiling planning: Great flexibility for design of patterns and interesting lighting effects. Modern, trim, clean appearance, free from light leaks or blemishes. No visible catches, latches, hinges or screws. Door frame opens or closes with simple pressure upwards (patented).
A wide choice of shielding media. Quickly and economically installed in virtually any ceiling construction. Ask the man from Smithcraft to explain these useful new features.



* Arthur W. Siegel, Massachusetts Representative, one of Smithcraft's nationwide sales organization

Smithcraft Troffers and other fine lighting units are installed in thousands of offices, factories, stores, schools and other types of installations from coast to coast. A typical installation is shown at the left — (Metro Troffers in Beerman's Department Store, Dayton, Ohio provide 75 foot candles of evenly-distributed illumination). Wherever good lighting is important, you'll find . . .

SMITHCRAFT — "AMERICA'S FINEST FLUORESCENT LIGHTING."

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Smithcraft LIGHTING, CHELSEA 50, MASS.

NAME_____ TITLE_____

☐ Please send me the monthly publication, "Light Side of the News", so that I can keep in touch with the latest trends in lighting.

☐ Please send me "YOUR CEILING PLANNING COMES TO LIFE", a complete handbook on one and two-foot wide SMITHCRAFT ARCHITECTURAL TROFFERS.

☐ Please send me the complete SMITHCRAFT CATALOG, containing data on "America's Finest Fluorescent Equipment".

Smithcraft
LIGHTING
CHELSEA 50, MASSACHUSETTS

THE AIR WE

Breathe...

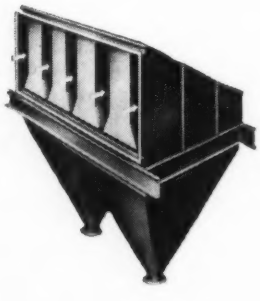
. . . . must be safeguarded against contamination. Every public-spirited industrialist realizes the importance of clean air to community good will, plant employee relations and the safety of his plant and its equipment.

Prat-Daniel has made notable contributions, during thirty years of research and manufacture, to the dust and smoke abatement programs across the nation. By promoting good public relations and protecting sensitive machinery, P-D Collectors have performed an outstanding service.

One of the many developments that have contributed to this success is an exclusive, patented, unique design of internal gas flow, known as *PLENAFLO. This feature eliminates recirculation, reduces wear, provides accessibility to every tube and improves efficiency.

The Thermix Corporation, Project Engineers, will be glad to send you a bulletin fully explaining this new idea in tubular design. Ask for Bulletin on P-D dust collectors featuring PLENAFLO.

*Trademark



pd

Project Engineers

THE THERMIX CORPORATION

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(Offices in 38 Principal Cities)

Canadian Affiliates: T. C. CHOWN, LTD., Montreal 25, Que.

Designers and Manufacturers

PRAT-DANIEL CORPORATION

SOUTH NORWALK, CONN.

POWER DIVISION: Tubular Dust Collectors, Forced Draft Fans, Air Preheaters, Induced Draft Fans, Fan Stacks

Elgin National Watch Co. and Walter Kidde Nuclear Laboratories, Inc. About the size of the head of a thumb tack, the battery has a nominal power output of 20 microwatts. It uses about 4½ curies of Promethium-147, a radioactive element with a half-life of 2.6 years. It is expected to have application in such products as hearing aids, miniature portable radios, and civil defense warning receivers for the home, as well as for an atomic powered wrist watch.

AN ARGONAUT reactor will be installed in the nuclear reactor center planned for West Caldwell, N. J., by Daystrom Nuclear Division of Daystrom, Inc. Under what is to be known as the Dart plan, Daystrom will offer colleges and univeristies a "nuclear package" that will include training of personnel at the West Caldwell laboratories, formal engineering surveys of campus reactor sites, complete installation of an Argonaut 10-kw reactor, and continuing consultation on reactor applications and uses.

THE AIR FORCE will provide Bell Telephone Laboratories at Whippany, N. J., with a heavy water research reactor to allow Bell to carry out an expanded program for research in nuclear physics. Objectives of the program are to make available more information about electric, magnetic, and structural properties of solids, and to study effects of nuclear radiations on materials and components used in military electronic systems.

A FAMILY of small, light nuclear power packs, having a shelf and use life of over 25 years and capable of operating over wide ranges of temperatures, acceleration, and vibration, have been developed by the Patterson Moos Division of Universal Winding Co. The packs contain a strontium-90 nuclear battery with current ratings from 5 to 5000 micro-microamps and equilibrium voltages in the order of 10,000 v. Although the packs are listed presently as suitable for use in weapons and ordnance systems, the company is investigating applications for peaceful purposes.

THE PROPOSED Case Industrial Nuclear Center came a step nearer to realization with announcement that five Ohio firms will participate in study of the feasibility of building a 10,000-thermal-kw high flux research and test reactor in the Cleveland area. The firms are the Austin Co., Cleveland Electric Illuminating Co., Republic Steel Corp., Standard Oil Co. of Ohio, and Thompson Products, Inc.

F & P AUTOMATION IN ACTION

The new alkylation unit at the McMurrey refinery in Tyler, Texas, is controlled by a graphic instrument system manufactured by Fischer & Porter Co. One man can control the entire operation of this 2200 BPD unit. In similar installations, F&P automatic digital data logging systems are successfully measuring and tabulating all operating variables.

Your clients' processes can be controlled just as efficiently. F&P's experience in supplying high-quality control systems for every kind of industry assures your clients of dependable, trouble free, high-accuracy performance. Carrying our responsibilities right on through commissioning of the control system, as well as its maintenance, relieves you of installation headaches too.

Whether you're designing a new facility or modernizing an old one, now is the time to put automation to work . . . F&P automation. For more information write to Fischer & Porter Company, 4937 County Line Road, Hatboro, Pa.

FP FISCHER & PORTER CO. Hatboro, Pa. U.S.A.

COMPLETE PROCESS INSTRUMENTATION

The Word *from* Washington

EDGAR A. POE
Consulting Engineer Correspondent

DESPITE a lag in about a half-dozen states, the 13-year, 40,000-mile interstate highway construction program, is off to a good start. With only eight months having elapsed, some 36,000 miles of the program have already been pin-pointed.

The Bureau of Public Roads is working closely with the various state highway departments to standardize and simplify methods in order to conserve engineering manpower, money, and time.

Officials of a few states have proposed that Congress look ahead toward adding yet another 10,000 miles to the 40,000-mile system authorized in 1956. The Legislatures of more than 40 states are in session this year, most of them for the first time since the mighty program was approved by Congress. Officials in Washington feel that what the state law-making bodies do will have great bearing on the future road building programs in the United States. There could be no better time for consulting engineers and their associations to become acquainted with their state representatives.

THE USS Nautilus, the first nuclear-powered naval vessel ever launched, has been operating successfully for over 20 months. As a result, the Navy is letting more nuclear-powered submarine contracts to shipyards.

As the USS Wolf is nearing completion, the Navy has let contracts for three more submarines at a total cost of $66 million. Perhaps other types of nuclear reactors will propel these three, two of which will be built by Ingalls Shipbuilding Corporation, at Pascagoula, Miss. The other will come out of the Electric Boat Division of General Dynamics Corporation, at Groton, Conn., at a cost of $25 million. The Pascagoula shipyards currently are holding more than $190 million in shipbuilding contracts for various types of vessels.

RACKETEERING in organized labor apparently is in for the most searching scrutiny it has ever faced since labor put on long pants and became a political power. Some of the top labor bosses will be called to testify. Sen. John L. McClellan, Democrat of Arkansas, with "no axes to grind," and with great moral courage, will direct the far-reaching inquiry.

ALTHOUGH it is still in the talking stage, some Senate and House members on the Interstate Commerce Committees feel that the time may be approaching when a Department of Transportation should be created. With the nation's population now 170 million, new problems of transportation are increasing. Railroads and trucks are regulated by the Interstate Commerce Commission, shipping by the Maritime Administration, and civilian air transportation by the Civil Aeronautics Administration. Entry of foreign air lines also poses new problems.

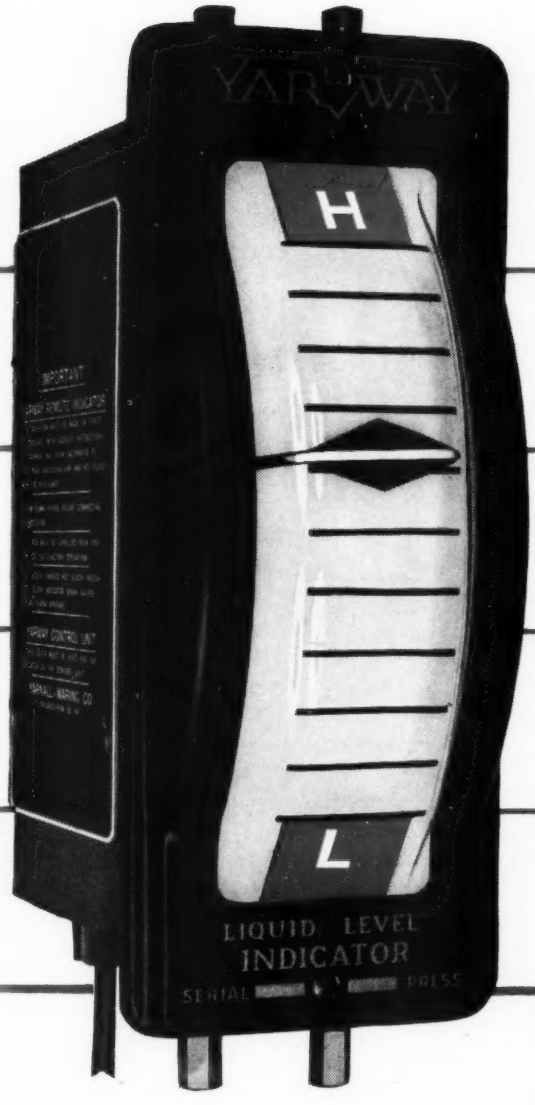
CHAIRMAN William McChesney Martin of the Federal Reserve Board, declares that the growth in savings in 1956 was not enough to keep pace with all the increasing demands for credit. He maintains that fully half of the increase in gross national product in 1956 represented a mark-up in prices. Had commercial banks been able to generate all the demands for funds, the result would have been a smaller rise in interest rates — but at the expense of a sharper rise in prices.

IN the face of an expanding and booming economy, we seem to have overlooked scores of depressed industrial communities in scattered sections of the country.

Both the Senate and House labor committees, however, are scheduled to conduct new hearings and study the persistence of localized unemployment in these communities.

Meanwhile, the National Planning Association's special committee on depressed areas has issued a policy statement that is regarded as important in congressional circles. The report advocates Federal aid to the cities and towns and the employment of technical assistance in an effort to revitalize the local economy. Technical assistance of consulting engineers has been an important part of United States' aid to undeveloped countries, and it is possible that similar technical aid could be of value in our own back yard.

Thus the methods used overseas could be appropriately applied to this country, according to the NPA's special committee findings. Other suggestions include financing new plants through government loans, or the guarantee of private loans. ▲▲



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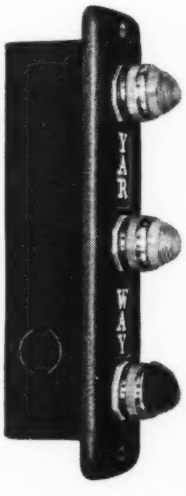

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Surveying with Plane and Camera

WILLIAM O. BAKER
Michael Baker, Jr., Inc.
Consulting Engineers • Planners • Surveyors

William O. Baker, whose father was a civil engineer and whose brother, Michael Baker, Jr. is head of the consulting firm of that name, entered the Air Force in 1941 and served as a pilot in the Troop Carrier Command in the Middle East and European Theatres. He received the Air Medal and Presidential Citation three times during the Normandy and Holland invasion. After the War, he attended Pennsylvania State University where he received, in 1948, a B.S. in Civil Engineering and took graduate work in photogrammetry. He also attended the University of Michigan and M.I.T. for special courses in soil mechanics and sanitary engineering. He has been with Michael Baker, Jr., Inc. since 1948 and in charge of the photogrammetric section since 1954. This department has completed well over a million dollars worth of mapping for the government besides much private work. William Baker is a registered engineer in Pennsylvania, a junior member of ASCE, a member of the American Society of Photogrammetry, and president of the Beaver County Chapter of the Pennsylvania Society of Professional Engineers.

ON A ROCKY HILLSIDE in western Pennsylvania, an area too tough to measure accurately by any other means, a photogrammetric survey has been accepted by both the construction trade and State agencies. The specific location is a 2½-mile stretch of Constitution Boulevard, near Aliquippa, Pa. The obsolete two-lane road had become a death trap as traffic volume mounted along the stretch that runs down the busy west bank of the Ohio River.

The Problem Stated

It was obvious that a four-lane road was needed, but Constitution Boulevard ran flush against a railroad line on the river side and butted against a massive cliff on the other. It was understandable, then, that a decision was put off as long as possible. Finally, it boiled down to just one way out — to cut away the cliff in a series of benches to protect against slides and provide the needed room for the widened road.

With this decision made, State highway officials were faced with a difficult problem. There was just no economical way to send surveying crews in to do the job within the time that public opinion and safety demanded.

The ultimate decision on how to handle the surveying and specification writing for this job was guided partly by the fact that our firm, Michael Baker, Jr., Inc., has considerable experience in photogrammetric operations, and we are headquartered just a few miles downriver from Aliquippa, at Rochester, Pa. For years we have worked closely with the Highway Department in Pennsylvania and other states on road planning and specification. The difficult terrain in which a good deal of our work is done led to committing ourselves heavily to photogrammetric techniques.

Working closely with Pennsylvania highway officials, we aerial-mapped the Constitution Boulevard site in great detail. The hillside was mapped with five-foot contours. The specifications for the excavating job then were written from the aerial surveys. For the first time in the history of Pennsylvania State highway construction, it was specified on this job that final payment on the excavating contract would be made on the basis of photogrammetric surveys following completion of the work.

In other words, the plan is for the Baker company to make aerial maps before and after the excavation, with payment to the contractors to be based on volumes of cut and fill computed from these maps.

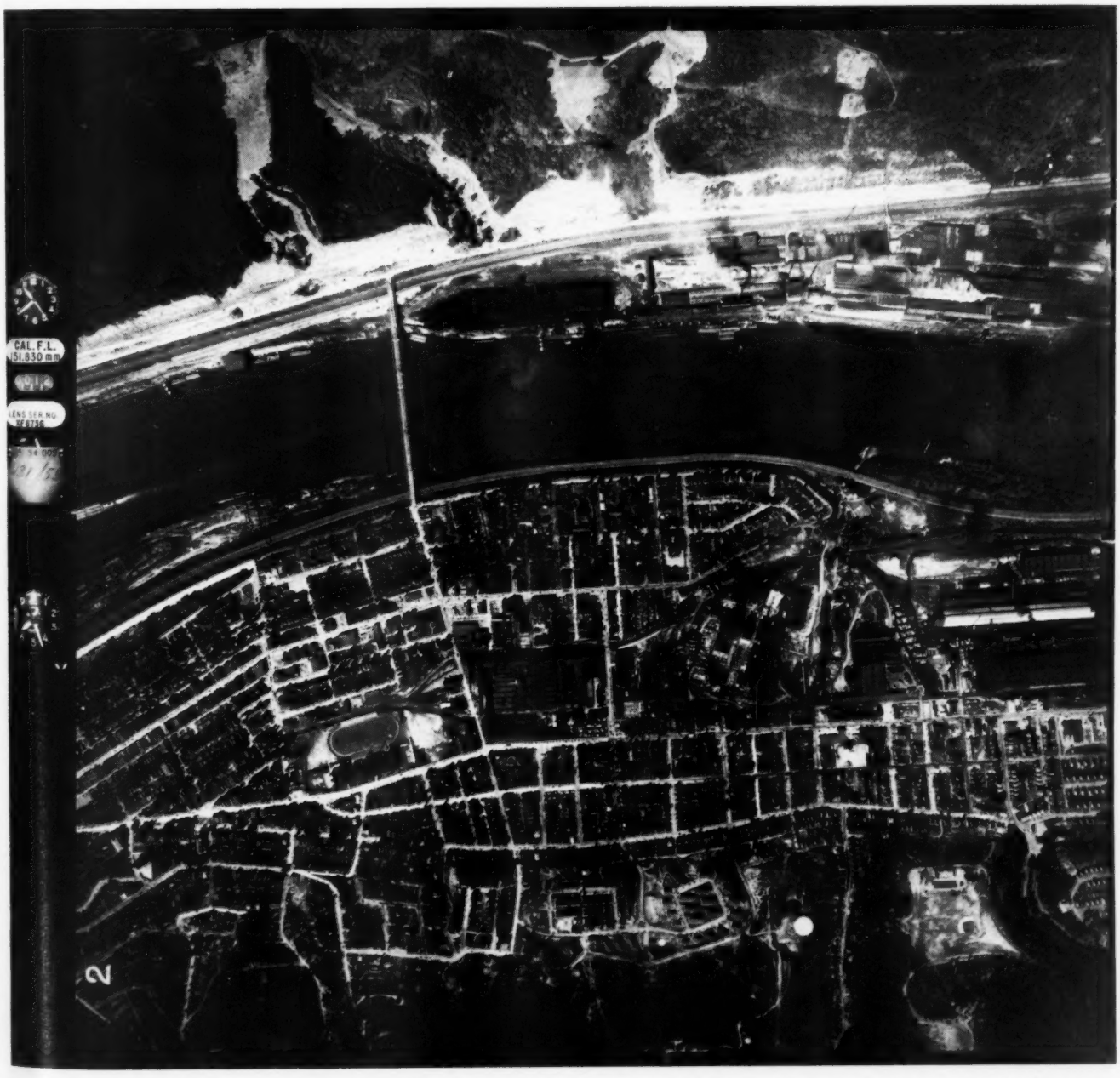
Accepted by Contractors

The fact that more than 30 contractors took out plans on this job and that about a third of them put in bids is proof of the high degree of acceptance photogrammetry has achieved here. Some idea of the proportions of the job can be had when it is understood that along a 2½-mile stretch there were some 2,800,000 cubic yards to be excavated. The Nello L. Teer Company, of Durham, N. C., turned in a low bid of $1.29 per cubic yard.

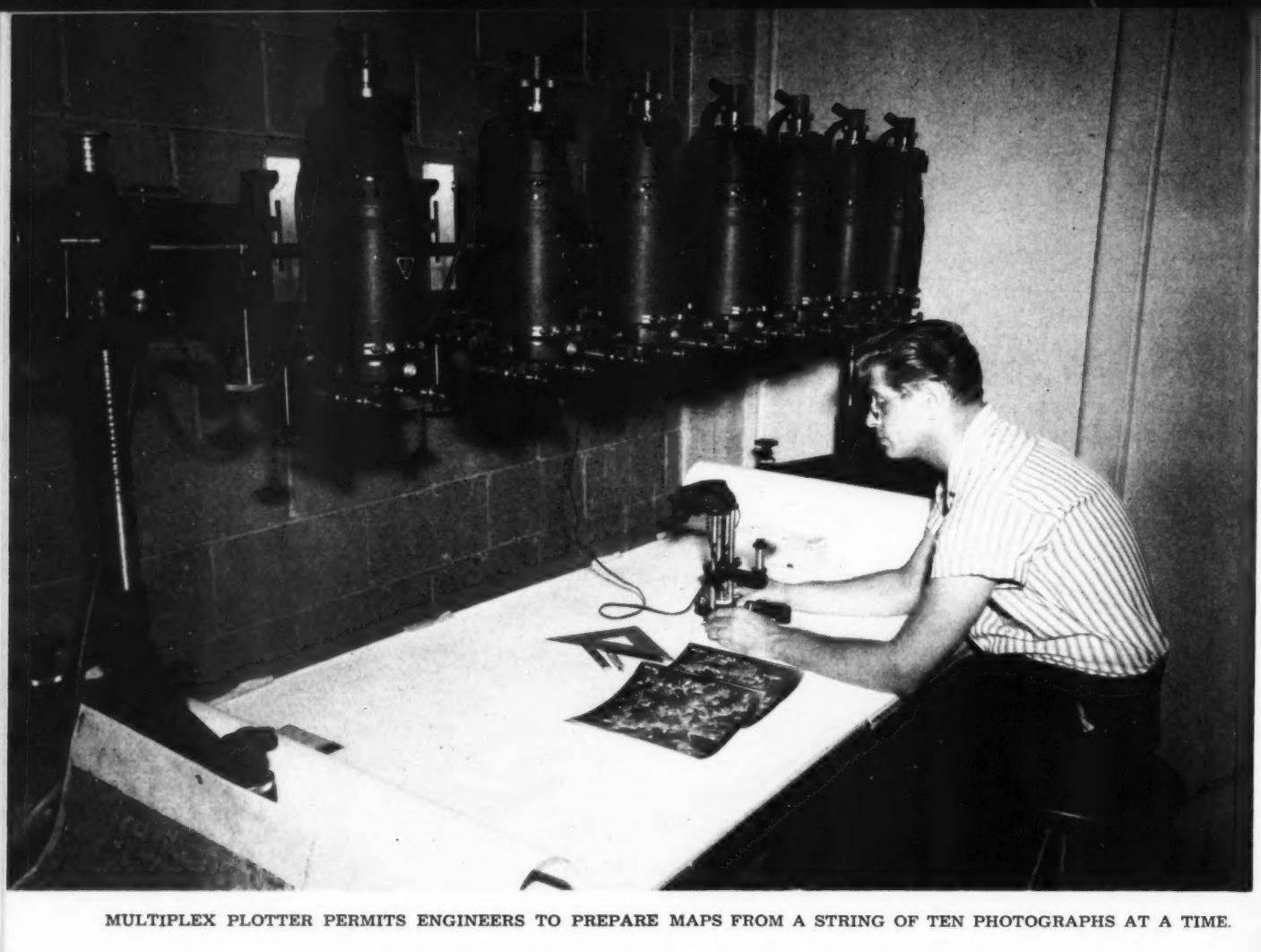
At this writing, the Constitution Boulevard job is almost completed. The site has been flown and mapped by the Baker aerial mapping staff at intervals throughout the construction. By now, there is no room to doubt the ability of photogrammetric mapping to achieve a degree of accuracy well within the five-percent tolerances set for this work. Physical spot-checks against the aerial maps have proven that, starting with photographs shot at 2400 feet, we can come up with finished maps whose two-foot contour lines are accurate to within one foot. We averaged three-inch accuracy when spot-checked by the ground surveys.

We now feel that our photogrammetric department has dovetailed ideally into the comprehensive highway engineering program of our firm.

One of photogrammetry's biggest selling points



VERTICAL AERIAL PHOTOGRAPHS, ACCURATE TO LESS THAN A FOOT, ARE USED TO PRODUCE FINAL AERIAL MAP.



MULTIPLEX PLOTTER PERMITS ENGINEERS TO PREPARE MAPS FROM A STRING OF TEN PHOTOGRAPHS AT A TIME.

in highway engineering is that both its cost and degree of accuracy can be tailored to any job. Just as with mapping through ground surveys, the engineers ordering the work are in full control of the dimensions, details, and degree of tolerance of the finished product. Along Constitution Boulevard, for example, it was necessary to develop scale maps with two-foot and five-foot contour lines so that the volume of earth and rock to be excavated could be computed accurately.

Cost and Accuracy

On any job both the cost and accuracy of the aerial maps can be tailored to the job at hand. If, for example, a job had not yet progressed to the building stage, and highway engineers wanted a broad, comprehensive map to help them select the most efficient route, it probably would be satisfactory to lay in contour lines at 10-foot intervals. Then both the aerial photography and the actual plotting of the map could be handled far less expensively.

Our firm is in a particularly good position to capitalize on photogrammetry's flexibility because we own our own equipment, from the airplane to the plotting board, and we can control work specifications minutely.

The company's plane is a Cessna 195, equipped with a Fairchild T-11 aerial camera. Manned by a full-time pilot and an aerial photographer, our plane shoots all of its mapping assignments under the standard procedure of allowing a 60-percent forward lap on its frames. The speed of film advance and shooting intervals are controlled automatically by settings on the camera's intervalometer. As a general rule, exposures are made at 1/300th of a second with the camera's six-inch lens set at f/6.3. Exposure is on Kodak Super-XX aerial film. Pictures measuring approximately 9½-in. square are made on rolls of film up to 400-ft long.

Selecting the Height

The height of the plane during this work is the chief factor controlling the amount of detail that can be put on the finished map. We will guarantee the accuracy of mapping an area to two-foot contours from pictures taken at 2400 feet over the terrain. If five-foot contour lines are specified, the job can be shot from 6000 feet and less than half the number of pictures used. The engineers who plot the maps have sent the plane as high as 14,000 feet.

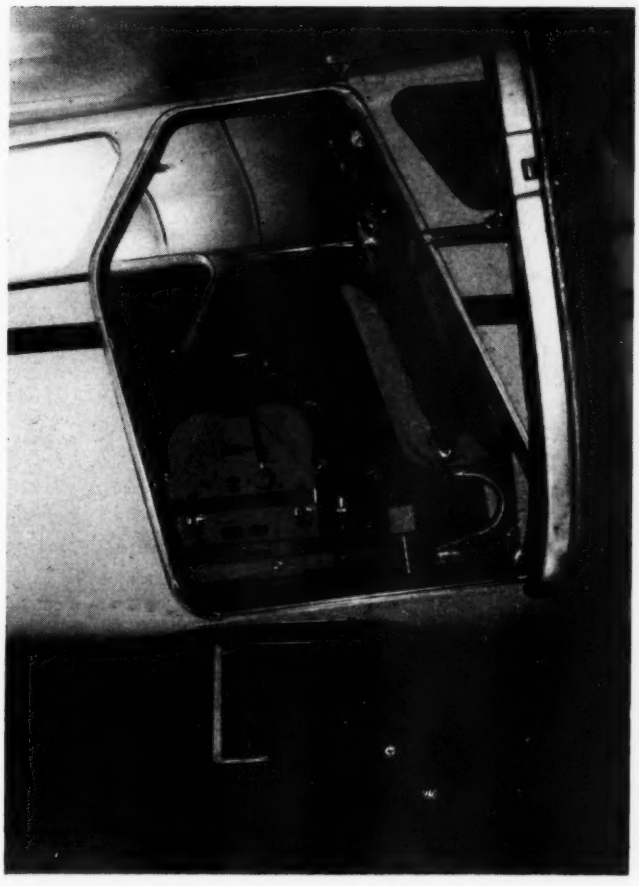
We establish control in production of aerial maps through the use of a set of contact prints on Azo paper made from the original negatives. Studying the contact prints carefully, we can establish a series of reference points to serve as guides in plotting the map. We specify the reference points simply and

accurately by putting pinholes through the prints. The prints themselves then are turned over to ground parties who go to the actual site and establish exact coordinates and altitudes for these points.

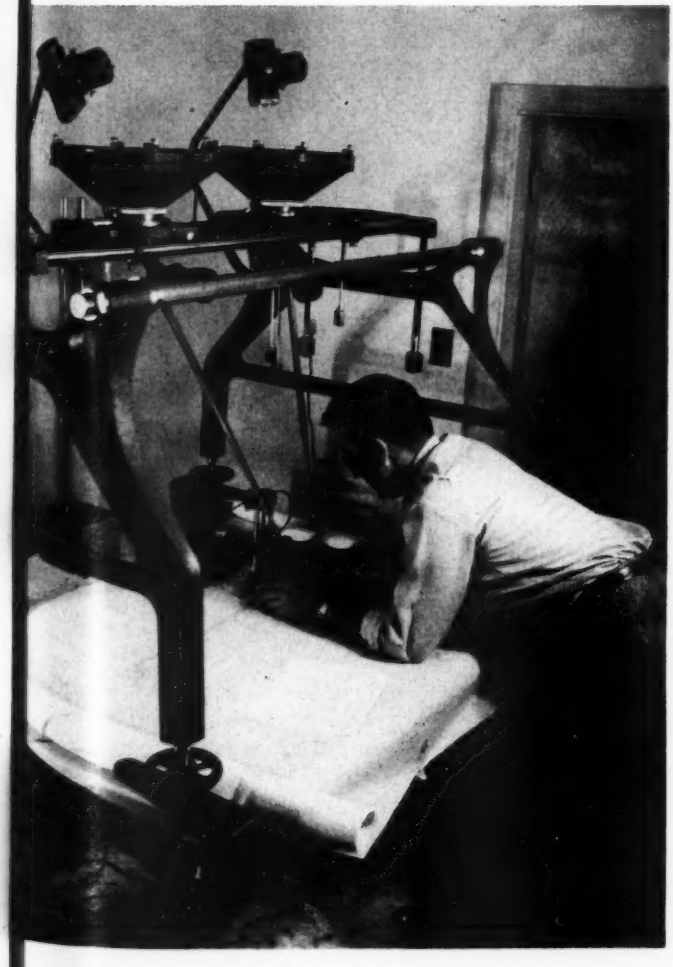
Plotting Methods

The actual plotting of the maps can be handled by either of two methods, depending on tolerances to which they will be drawn. Where the requirements are tight, the photographs are matched and worked in pairs on a Kelsh plotter. For broader area mapping, the work is done on a Multiplex unit which enables us to prepare maps from a string of 10 photos at a time. Either way, we use the overlapping portions of the aerial photos to create a three-dimensional image.

With both methods the images are projected from diepositive plates. With the Kelsh units, these plates are full-size, contact prints. On the Multiplex, the plates, made on a special optical printer, are 64mm. Projection of the images is alternately with blue and red lights, so that the operator, wearing glasses with one blue lens and one red one, gets a three-dimensional effect. With the projectors set in positions corresponding in scale to the location of the plane



A FAIRCHILD T-11 AERIAL CAMERA USING 400-FT FILM ROLLS IS MOUNTED IN BAKER'S CESSNA 195.



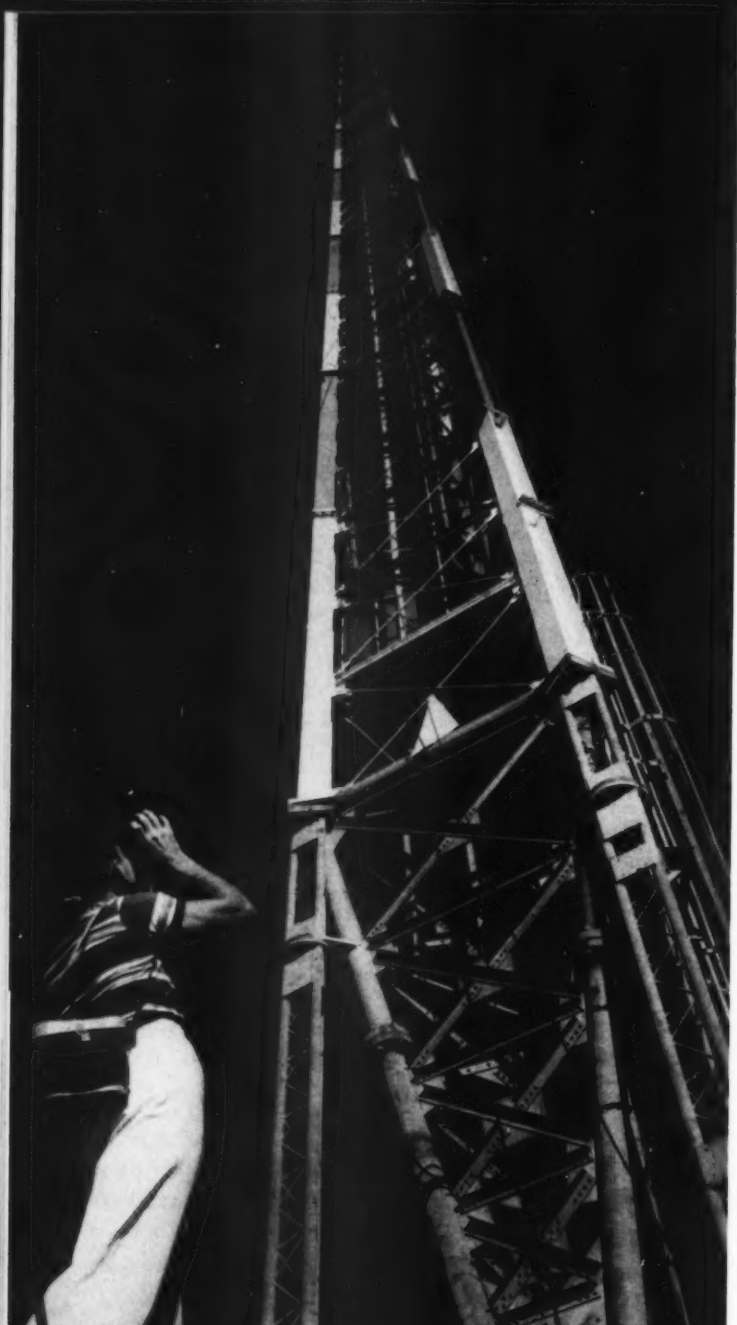
WHERE SPECIFICATIONS ARE HIGHLY CRITICAL THE KELSH PLOTTER PERMITS ACCURATE CONTOUR WORK.

at the time the photograph was made, a mechanical tracing device, when moved across the face of the plotting board, automatically adjusts for parallax and reads the altitude at each location.

Conversely, the reading table can be set for a given altitude and contour lines are plotted by keeping a reference point on the table moving on the ground surface as seen in the three-dimensional image. As this reference dot is moved along in contact with the visual ground, a pencil beneath this tracing table actually draws the contour line on the map below. The accuracy of these mapping operations is achieved by establishing and cross-checking the data brought in by the field party on reference points marked on the original contact prints.

To understand the benefits of photogrammetry, picture field surveying parties struggling their way up and down the rocky hills of western Pennsylvania. Obviously, it is faster and more economical to fly over the country than to crawl over it afoot.

The cost of mapping Constitution Boulevard photogrammetrically was about 10 percent of what it would have cost to do the job on the ground. Now, with this road setting a precedent in actual payment for contractor performance on the basis of photogrammetric surveys, it seems an automatic conclusion that the future of aerial photography is brighter than ever. ▲▲



THIS 1572-FT HIGH TOWER USED BY KWTV IN OKLAHOMA CITY IS THE WORLD'S TALLEST MAN-MADE STRUCTURE.

How to Approach the Design of Tall Guyed Towers

CE exclusive

ONE OF THE MOST IMPORTANT technical developments of our age is the growth of radio and television communication. Although not always recognized, this development could not have been possible without the concurrent development of tall towers to support radio and TV antennas. Indeed, the demand for higher and higher towers has taxed the ingenuity of both structural engineers and erectors.

Occasional tower failures during severe weather conditions and sometimes during erection have made the public aware of their unusual height and complexity. Today, slender masts, towering higher than the tallest skyscrapers, support antennas that extend into the clouds an additional 80 to 100 feet. These masts, prevented from falling by the spider

E. I. FIESENHEISER
Professor and Director
Department of Civil Engineering
Illinois Institute of Technology

E. I. Fiesenheiser, director of the department of civil engineering at Illinois Institute of Technology, holds two engineering degrees from Purdue and one from Illinois Tech. He is a licensed engineer in Illinois and Minnesota and holds full membership in six professional engineering societies. He began his work in structural engineering with the American Bridge Company, later working for the U. S. Bureau of Public Roads and the Chicago Sanitary District before entering the field of engineering education, in 1943. Since then he has served progressively as instructor, professor, and director of the civil engineering department besides being active in consulting, research, and writing. He has been connected with a number of large structural design projects and has become known as an expert in stress analysis and design of tall steel towers. He was also a structural consultant for the Institute of Nuclear Studies of the University of Chicago during the construction of their large cyclotron. His work on this project involved the design of parts of the cyclotron and the design and supervision of construction of the heavy concrete shielding. Mr. Fiesenheiser designed a new engineers' slide rule now in wide use, and he is co-author of a technical manual for U. S. Army officers concerned with the design and construction of military bridges—"TM 5-260 Principles of Bridging."

webs of almost invisible and seemingly fragile guys, now make possible the benefits of radio and television entertainment in many communities far distant from the large cities. The design of these structures presents an interesting and somewhat complex engineering problem.

Action of the Typical Guyed Mast

Horizontal wind loads are usually the most severe forces to be considered in design. Therefore, the relatively slender but powerful mast ought to be streamlined to offer minimum resistance to the wind. However, combinations of nature's forces, as represented by ice loads, temperature changes, dead load of the structure itself, and winds of hurricane velocities, need to be considered. The mast is relatively stiff when compared to the slender flexible guys. When the wind deflects the mast laterally, the guys on the windward side stretch elastically as would rubber bands. Because of the movement of the mast, the sags of the leeward guys increase. When this happens the pull of the windward guys is increased until the forces find equilibrium, and the movement is stopped. The action of the mast is similar to that of a long slender beam carried on many elastic supports. Each set of guys provides an additional support whose stiffness is governed by the size of the guy cable and its length. The structure also may be thought of as a continuous beam supported on springs, each spring having a different spring constant.

The Ideal Design

Structural engineers are accustomed to dealing with continuous beams on unyielding supports. Such structures are complex in themselves, and their correct analysis requires a knowledge of the principles of indeterminacy and the techniques involved in applying some method such as moment distribution or slope deflection. When, however, the supports themselves deflect elastically under load, the analysis becomes many times more involved. Spring constants for previously selected guys can be determined and used, but the setting up and solving of multiple simultaneous equations, one equation for each elastic support, cannot be avoided. Such equations can be solved by a systematic check method with the aid of a calculator. Hence the complete general analysis does not present an unsolvable problem, although with a haphazard selection of guy sizes and lengths, the mast will not remain straight when it moves under wind load. Some guy supports will provide too little, others too much resistance, and the mast will be forced into undulations and bending deflections by the guys themselves — a very undesirable condition which creates unnecessarily high stresses in the mast.

A much better and simpler design procedure is to determine first the required guy resistances at each support for a straight-line mast deflection in which the mast leans away from the wind by pivoting about its base; then to determine the areas and lengths of guys of each set to provide this resistance. This method might be called that of adjusting the spring constants of the long continuous beam so that a straight line drawn from tower base to the top support point will pass through all support points. The mast then can be designed as a continuous beam on unyielding supports, since there will be no relative support displacements, and the guys will later be designed and their areas and lengths selected so that they will provide just the correct amount of resistance. This procedure furnishes not only a less laborious design but one that is safer and more economical.

Design Investigations

Designs should be investigated for combinations of loads thought to be the most reasonable maxima for all adverse weather conditions. In cold climates these usually consist of an ice cake on all parts of the mast and antenna of at least ½ an inch — and at least ¼ of an inch all around on each guy. In addition, a high velocity wind pressure acting on the vertical projected area of all parts when covered by ice, combined with a temperature drop of perhaps 70 F, should be considered. The additive effect of all of these factors occurring simultaneously is considered to be the design load.

Masts usually consist of a trussed framework of posts, diagonals, and horizontal web members. Such frameworks can be safely considered to act together as would a beam in which the posts take the bending and direct stresses and the web members, consisting of diagonals and horizontal struts, take the shear. After calculation of maximum stresses in these various members, their design follows that of any

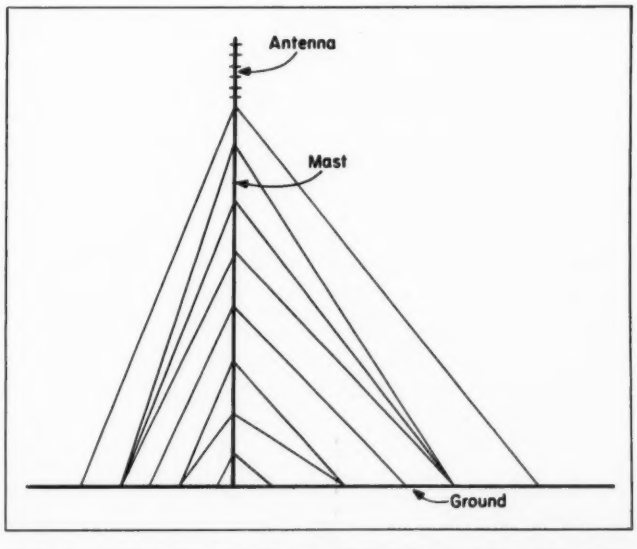


FIG. 1—ELEVATION VIEW OF ANTENNA, MAST, AND SUPPORTS IN THE PLANE OF THE RIGHT HAND SET OF GUYS.

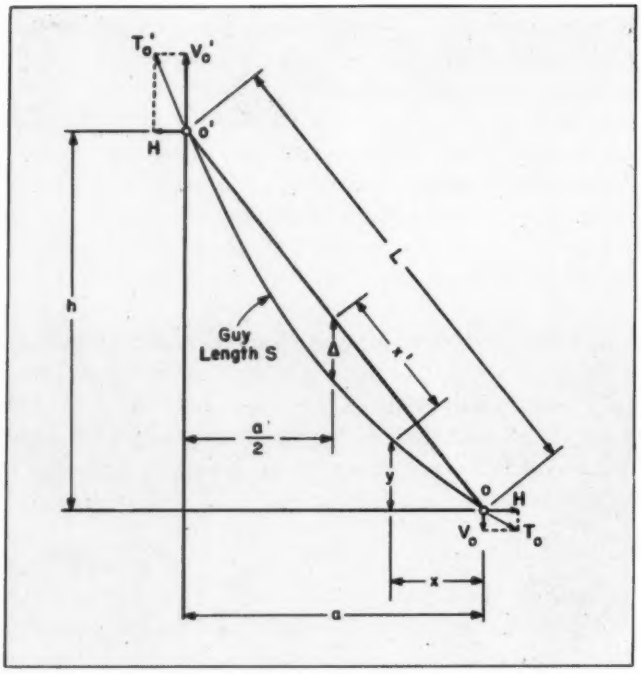


FIG. 2—SUPPORTS ARE SHOWN AS STRAIGHT IN FIG. 1, BUT THERE IS ACTUALLY A SAG AT THE CENTER LINE.

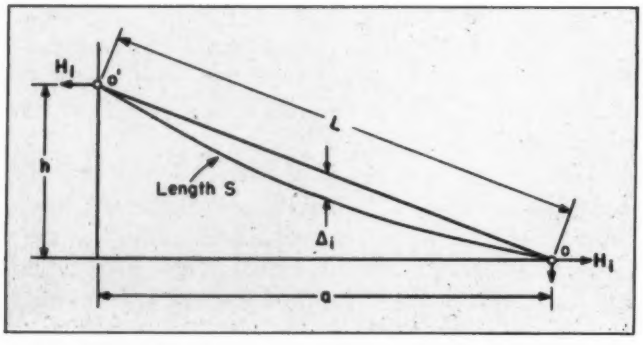


FIG. 3—THIS DRAWING SHOWS THE INITIAL HORIZONTAL COMPONENT OF TENSION FOR A LEEWARD GUY WIRE.

typical steel truss structure. Special attention should be paid to design of connections so that their strength will be adequate and so that erection will be simple and practical. For one experienced in the design of other steel structures, this part of the work is not difficult.

Guy Curve Equations

Calculation of guy end tensions involves the use of appropriate curve equations, some of which have been derived previously and are available in the literature pertaining to this subject. Precise equations can be used. Many of these, however, do not permit easy computation. Therefore, an effort has been made to formulate simple equations adapted to ease of calculation. In fact, these equations can be used entirely with slide rule computation, with no significant loss of accuracy.

The simplified line diagram of Fig. 1 represents an elevation view of antenna, mast, and supports in the plane of the right set of guys. The mast is guyed in three directions in plan, with 120 degree angles between adjacent supports. In Fig. 1 the guys are shown as straight. Actually, all of them are curved and an appreciable sag Δ exists at the center line, as shown in Fig. 2.

Forces in the guys may be taken as directly proportional to the vertical load or weight w, per unit of length L, which they carry. For most installations it is sufficiently accurate to assume this load to be uniformly distributed. By consideration of equilibrium of the forces acting on an infinitesimal increment of guy length and applying boundary conditions, the following curve equation results:

$$y = (wL/2aH)\ x^2 + (h/a - wL/2H)\ x \qquad (1)$$

From this, the following equations for the forces shown in Fig. 2 are derived.

$$H = wLa/8\Delta \qquad (2)$$

$$V_o' = (h/a)\ H + wL/2 \qquad (3)$$

Total maximum guy force:

$$T_o' = \sqrt{H^2 + (V_o')^2} \qquad (4)$$

$$V_o = (h/a)\ H - wL/2 \qquad (5)$$

Total maximum guy force at ground level:

$$T_o = \sqrt{H^2 + (V_o)^2} \qquad (6)$$

From equation (2) it is observed that horizontal component H is inversely proportional to sag Δ.

The guy curve for uniformly distributed load is of parabolic shape, and the total guy length S can be determined exactly by integration, but the resulting expression is not one adapted to slide rule computation. A sufficiently exact formula for S is derived by referencing curve coordinates to the sloping line oo′ in Fig. 2. The resulting equation

$$S = 2\int_0^{L/2} \sqrt{1 + (8a\Delta x'/L^3)^2}\ dx'$$

may be expanded into a binomial series which easily can be integrated term by term. The use of only two

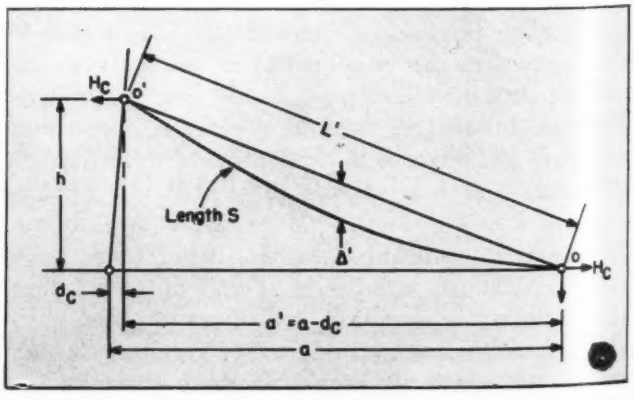


FIG. 4—FOR A SMALL MAST MOVEMENT THE DISTANCES a AND L ARE SHORTENED WHILE S REMAINS THE SAME.

terms provides sufficient accuracy. By this procedure

$$S = L + n \tag{7a}$$

$$\text{where } n = 8a^2\Delta^2/3L^3 \tag{7b}$$

Solving for the center line sag

$$\Delta = 0.6124\, L^{3/2}\sqrt{n}/a \tag{8}$$

From equation (8) it is observed that sag is directly proportional to the square root of n, the difference between the actual curve length and the straight length L.

When wind force acts, the mast moves away from the direction of wind, tightening the guys on the windward side. Simultaneously, guys on the leeward side relax their tensions somewhat as their sags are increased. For leeward guys appreciably large changes in sag accompany a relatively small mast movement. It is essential to be able to calculate the relaxation of force, in any leeward guy, which is produced by this movement.

Referring now to Fig. 3, the initial horizontal component of tension H_i is shown for a leeward guy. This can be calculated from equation (2) for a known initial sag Δ_i. Then

$$H_i = wLa/8\Delta_i$$

As shown in Fig. 4 for a small mast movement d_C, distances a and L are shortened to $a' = a - d_C$ and L', respectively. The original curve length S remains as before with no appreciable change. By use of equation (8) the new sag Δ' can be calculated. Then, in Fig. 4

$$H_C = w\,L'\,a'/8\Delta'$$

However, equation (8) is somewhat complex and

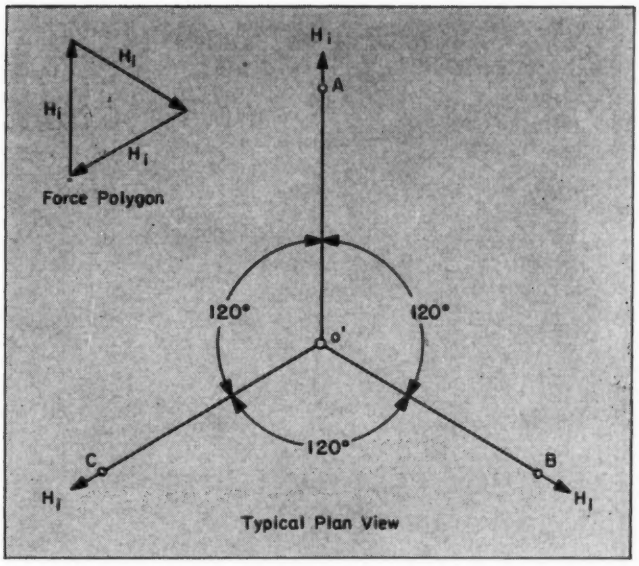


FIG. 5—TYPICAL PLAN VIEW AND FORCE POLYGON FOR INITIAL HORIZONTAL COMPONENTS AT CENTER OF MAST.

can be avoided. A sufficiently exact equation for Δ', derived from (8) is

$$\Delta' = k\,\Delta_i \tag{9a}$$

$$\text{in which } k = \sqrt{1 + a\,d_C/nL} \tag{9b}$$

$$\text{Then } H_C \text{ (approximately)} = wLa/8k\Delta_i \tag{10}$$

At ground level anchorage, if the initial tension T_o can be measured, the horizontal component H_i can be calculated by solving equation (5) as follows:

$$H_i = (a/2L)\,[\sqrt{4\,T_o^2 - (wa)^2} + wh] \tag{11a}$$

Often the second term under the radical, $(wa)^2$, is

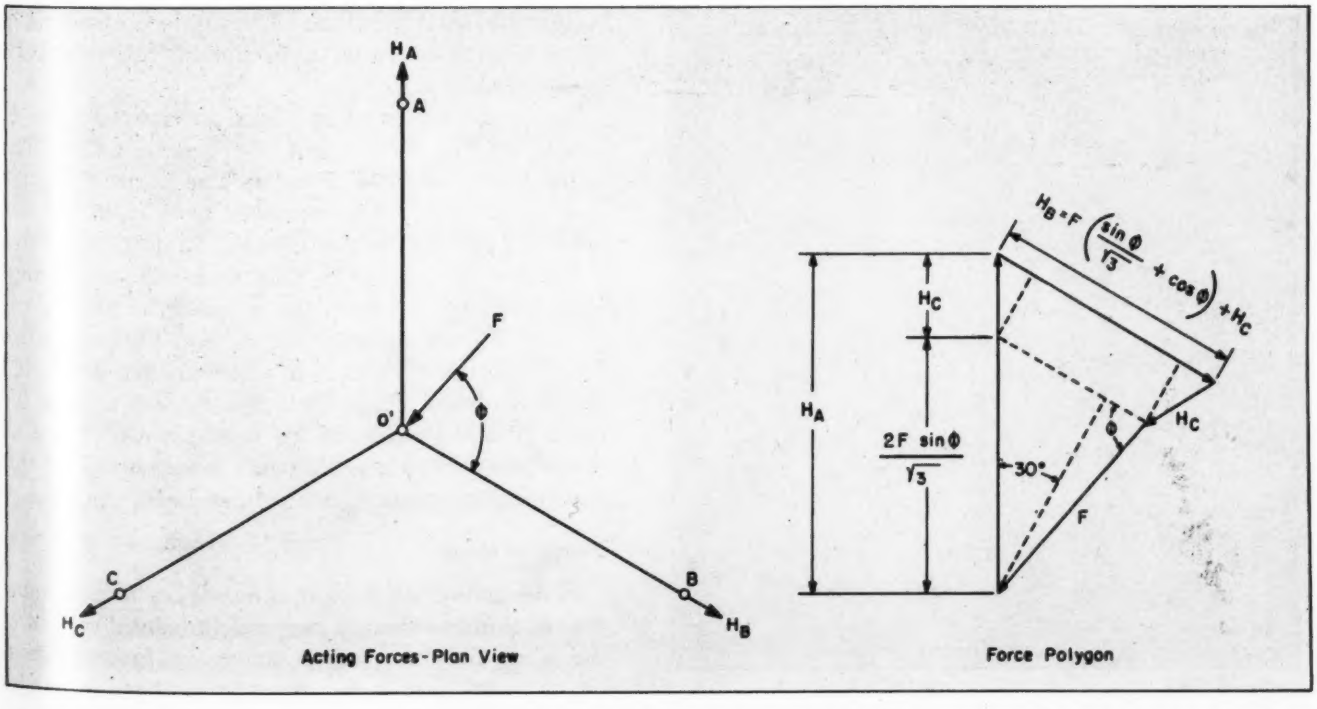


FIG. 6—GENERAL CONDITIONS WITH WIND FORCE F ADDED. ACTING FORCES ARE AT LEFT, FORCE POLYGON AT RIGHT.

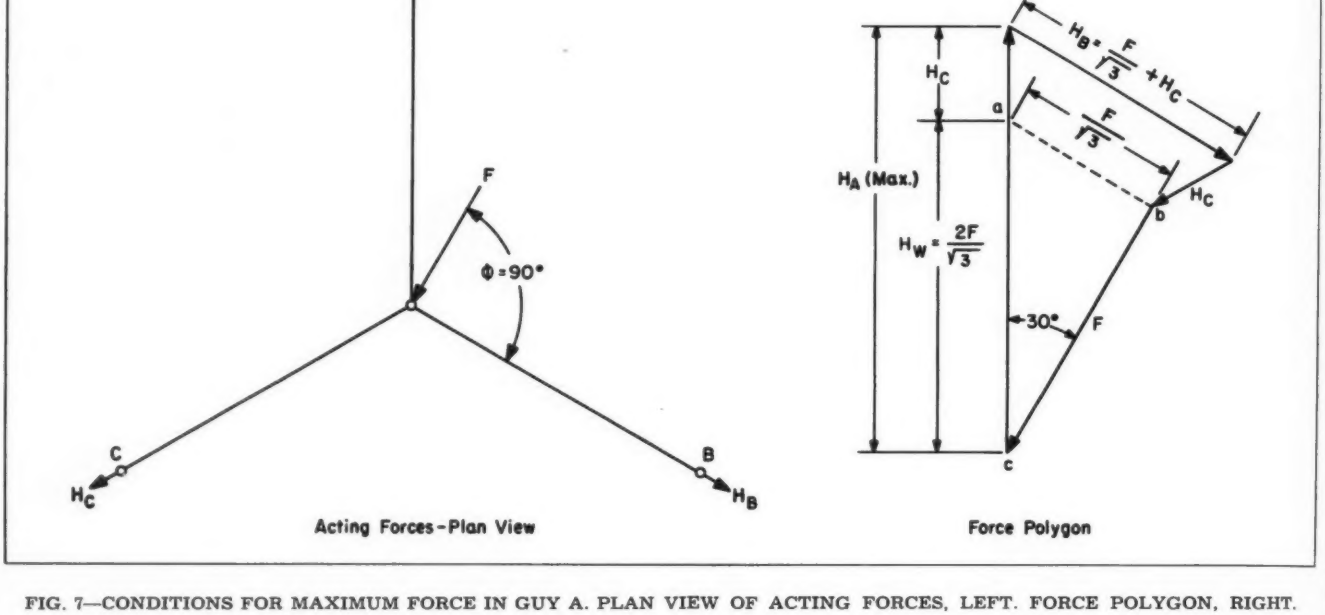


FIG. 7—CONDITIONS FOR MAXIMUM FORCE IN GUY A. PLAN VIEW OF ACTING FORCES, LEFT. FORCE POLYGON, RIGHT.

so small that it can be neglected. Equation (11a) then simplifies to

$$H_i = (T_o + wh/2)\ (a/L) \qquad (11b)$$

With H_i determined, Δ_i is easily found by substitution in equation (2).

Having derived all necessary equations pertaining to single guys, it is now necessary to consider the combined action of all guy forces with the force of the wind at a typical mast support point. From this study the mast movement can be calculated; the maximum tension in any one of the guys determined; and the guys can be designed.

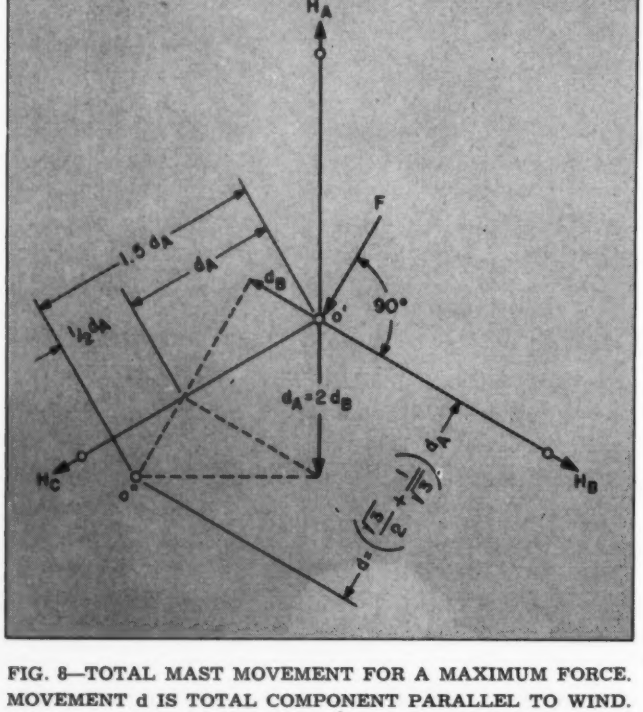


FIG. 8—TOTAL MAST MOVEMENT FOR A MAXIMUM FORCE. MOVEMENT d IS TOTAL COMPONENT PARALLEL TO WIND.

Mast Movement From Wind Forces

Fig. 5 shows the plan view of a mast (point o') with three guys symmetrically arranged, the angles between adjacent guys being 120 degrees. This symmetrical arrangement is desirable as it allows three equal size guys at each attachment point. Initially, before the wind acts, the horizontal components of initial tension are equal, as is evident from the closed force polygon.

Under the action of an added total wind force F, shown in Fig. 6, a four-force system exists. The initial forces are now changed. The horizontal force component of guy A is increased from H_i to the new value H_A and that of guy B to H_B. In guy C the force is reduced from H_i to H_C. Fig. 6 also shows the new force polygon, and from the geometry of this figure, H_A and H_B are determined. H_C can be determined from equation (10) as soon as the movement d_C has been calculated. These force changes can only be the result of a movement of the mast point o'. Since all three guy forces are changed, components of this movement must occur in all three directions.

Design of Guys

In designing the guys it is necessary to determine the maximum stress in any one for any direction of the wind. Selecting guy A for study, force component $H_A = H_C + F \sin \phi/\sqrt{3}$ which will be maximum when $\sin \phi$ is maximum, or when ϕ equals 90 de-

grees. This condition is shown in Fig. 7, and the force polygon of Fig. 6 now is simplified to that of Fig. 7. This condition also produces the maximum possible movement of the mast point o′. Components of this movement now can be determined.

Portion abc of Fig. 7 reveals directly the effects of force F on guys A and B. Since the effect on guy B is exactly one-half that on guy A, the component of mast movement in the direction of B will be one-half that in the direction of A. For tall towers these movements are very small relative to total guy lengths. Angle changes from the original 120 degrees, therefore, may be disregarded. Fig. 8 shows the total mast movement from o′ to o″. Point o″ is at the intersection of perpendiculars drawn from the end of plotted movements d_A and d_B, making use of the relationship that $d_B = \frac{1}{2}\, d_A$. From the geometry of this figure, $d_C = 1.5\, d_A$. Movement d is the total component of mast movement parallel to the direction of wind.

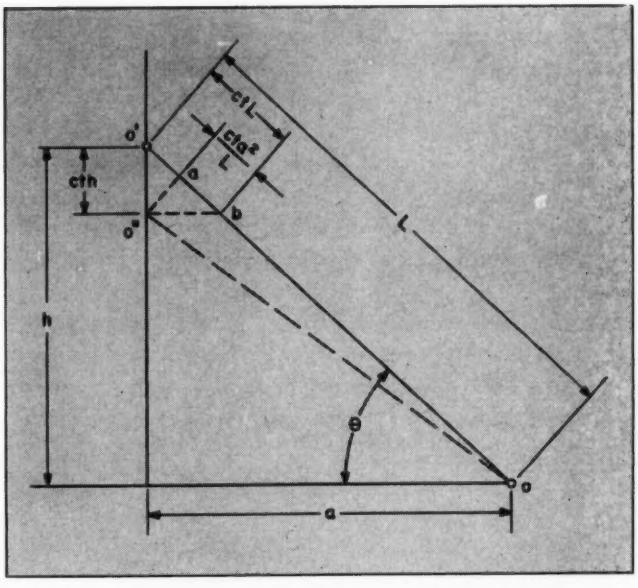


FIG. 9—A CHANGE IN TEMPERATURE AFTER ERECTION OF THE TOWER CHANGES THE TENSION IN THE GUYS.

Wind Force Equations

Equations in which wind force F is a factor now may be derived for the movements d_A and d. For most installations mast movements d_A and d_B are mainly the result of cable stretching due to the forces induced in these windward guys. Referring to Fig. 7, the horizontal component of elastic elongation of guy A will be approximately equal to

$$d_A = H_w\, L/AE = 2FL/\sqrt{3}AE \qquad (12)$$

in which A is the cross-sectional area of the guy cable and E is its modulus of elasticity. From Fig. 8

$$d = (\sqrt{3}/2 + 1\sqrt{3})\, d_A = 5FL/3AE \qquad (13)$$

For calculation of the relaxed force H_C in the leeward guy in equation (10), the value of d_C is needed in equation (9b)

$$d_C = (3/2)\, d_A = \sqrt{3}\, FL/AE \qquad (14)$$

In the above formulas the total wind force F should include the horizontal wind reaction R from the mast as well as the reaction produced by wind acting on the guys. A separate calculation for the mast will determine R, but the remaining portion of F may be determined directly. If p denotes the wind force per unit of guy length, it may be multiplied by one-half of the total length of all guys projected onto a vertical plane perpendicular to the wind direction. This results in $F = R + pL$. From equation (13),

$$d = 5FL/3AE = 5\,(R + pL)\,L/3AE.$$

Letting $Q = 3AEd/5$, the required length L for a mast movement d is

$$L = \sqrt{(R/2p)^2 + Q/p} - R/2p \qquad (15)$$

It is to be noted that an increase of cable area A also requires an increase in length L. In any event the selected area A must be adequate to provide for the maximum force T_o'. The variables A and L may be adjusted to develop the required force R in equation (15). Variations of area A are limited to selections from available commercial cable sizes, but there are no such limitations to design adjustments of length L. It is possible, therefore, to arrange guy lengths and cable areas to conform to a definite mast movement, at the location of each set of guys.

The recommended procedure for design of guys is

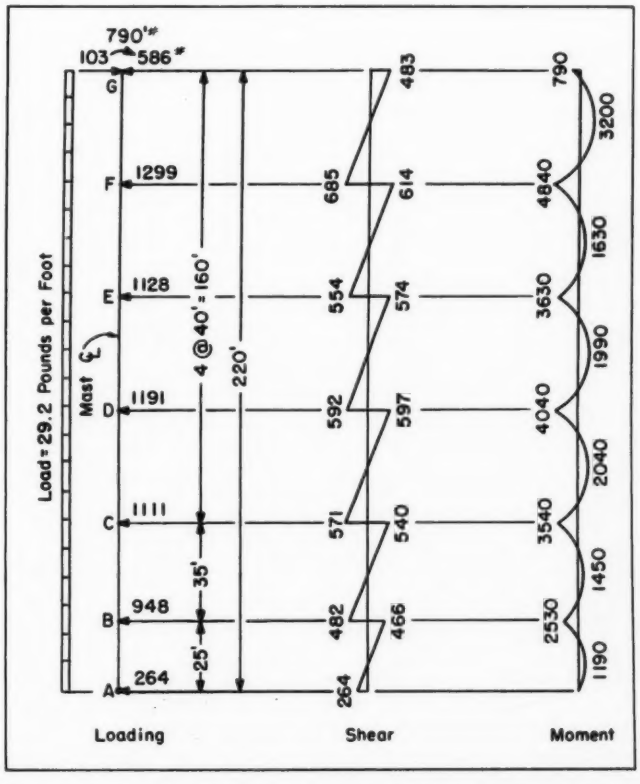


FIG. 10—MAST ANALYSIS DIAGRAM SHOWING SHEAR AND MOMENT VARIATIONS FOR HORIZONTAL FORCES ONLY.

to assume straight-line mast deflection with no relative displacements of supports of the continuous mast structure. The mast reactions R then can be calculated for each support point. Starting the design of guys with the top set, the movement d at the location of this set can be calculated from equation (13). The values of d at the locations of the other supports, proceeding down the mast, are proportional to the d first calculated and to the height h. Thus the value of d at each point down the mast is easily found. Equation (15) then can be applied at each point and the guy sizes and lengths determined. This procedure has been used for design of many towers and works out quite satisfactorily with normal slide rule computations.

Temperature Change Effects

A change in temperature after erection of the tower produces changes in tension of the guys. Rise in temperature relaxes the tension whereas a drop in temperature increases the tension. Therefore, a temperature drop effect is the only one which requires consideration. With sufficient accuracy this effect may be evaluated by use of the straight-line length L rather than the curved guy length S, which is relatively only slightly greater than L.

Referring to Fig. 9, L is the length at the time of tower erection. After a temperature drop, point o′ moves to o″. Distance o′o″ is the shortening of mast length. If the guy were not secured to the mast, its shortening would be the distance o′b. Since it is secured at point o″, it must stretch an amount approximately equal to distance ab. Point a is located by drawing line o″a perpendicular to line o′o.

Letting c be the coefficient of linear expansion per degree of temperature change, and t the number of degrees change (Fahrenheit), the distance $o'b = ctL$ and the distance $o'o'' = cth$. Total guy stretch is then cta^2/L. The resulting unit strain is obtained by dividing by L to obtain $ct(a/L)^2 = ctcos^2\theta$. Unit stress induced in the guy due to a temperature drop is then

$$f_t = ctEcos^2\theta \qquad (16)$$

The coefficient of linear expansion per degree F may be taken as $65(10)^{-7}$ for steel. The modulus of elasticity E is a property of the type of steel wire used in the manufacture of the guy cable strand. This data can be supplied by the manufacturer and will be a lower value than the 29 million psi ordinarily used for structural steel.

Mast Analysis

The mast must be capable of supporting all vertical components of all guy forces under the most adverse weather conditions. These effects may be calculated separately and superimposed to obtain the total maximum vertical forces brought in by the guys at each point of support. In addition, the mast must resist shear and bending moment produced by horizontal wind loading over its length combined with the moment delivered to the top of the mast by the antenna. Thus, the action of the mast is that of a vertical continuous member subject to bending, shear, and direct stress. Vertical direct stresses increase from top to bottom of the mast as a result of the addition of the vertical components of the guys at the various points of support—and its own dead load.

If, under the action of wind, the mast is to lean away from the wind, pivoting about its base with no relative displacements at points of support, its base should be designed with no restraint against rotation. This feature can be provided by a spherical type of bearing.

Line Diagram

Fig. 10 shows a line diagram representing a mast 220-ft high to point of attachment of the antenna at G. Lateral support is provided by sets of guys at six points G to B. With no relative displacements of these supports and a uniform mast section throughout, an analysis of the continuous member for the calculated loading by the method of moment distribution is not a difficult procedure. Here the wind loading, 29.2 pounds per foot of height, is applied from left to right. Using moment distribution (not shown) the support moments were determined. By considering all forces acting on each individual span, end shears and maximum moments in each span were calculated. Shear and moment variations, for horizontal forces only, are shown in Fig. 10.

The addition of shears at each support gives the horizontal reaction forces necessary to hold the continuous mast in equilibrium under the assumption of straight-line mast deflection. These reactions, at points G to B, are the forces R required in equation (15), which are used in the design of the guys.

At least three guys are required to provide equilibrium at each point of support. Three, however, are sufficient. This fact and other considerations of economy suggest a three-cornered mast section. This type, symmetrical in plan about a vertical centroidal axis, has another advantage in that it has equal stiffness in all directions. It is believed to be the most satisfactory type of mast section. ▲▲

Acknowledgement

The writer would like to express appreciation to Mr. Raymond Sauer, Supervisor of Structural Analysis Section, Armour Research Foundation of Illinois Institute of Technology. Mr. Sauer assisted with several tower design projects and most of the methods explained herein are the result of his and the writer's joint efforts.

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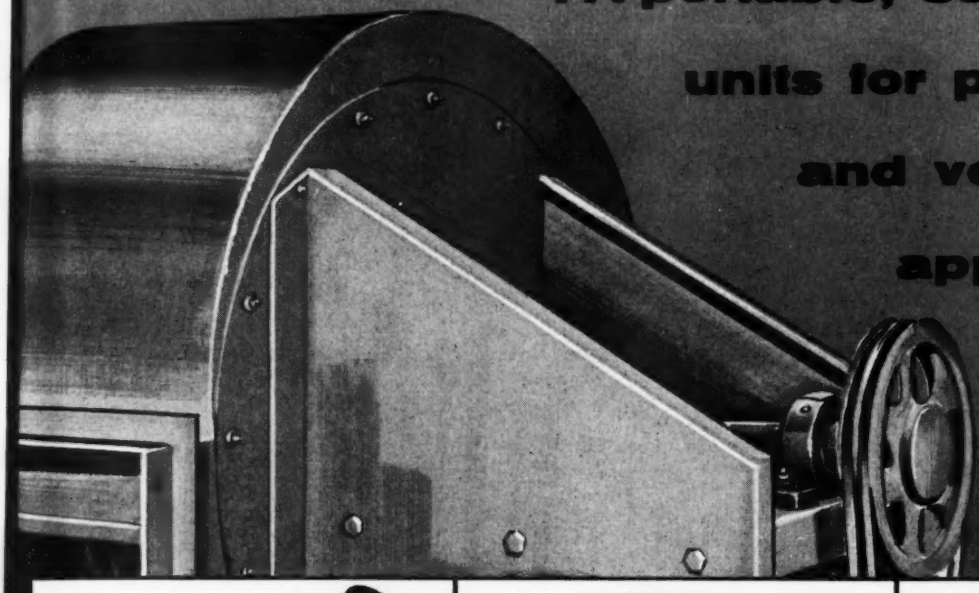

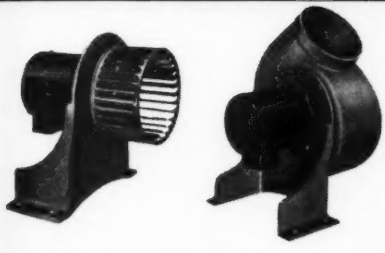

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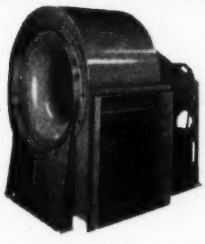

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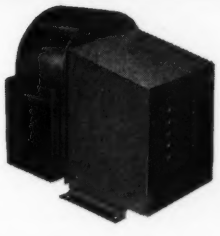

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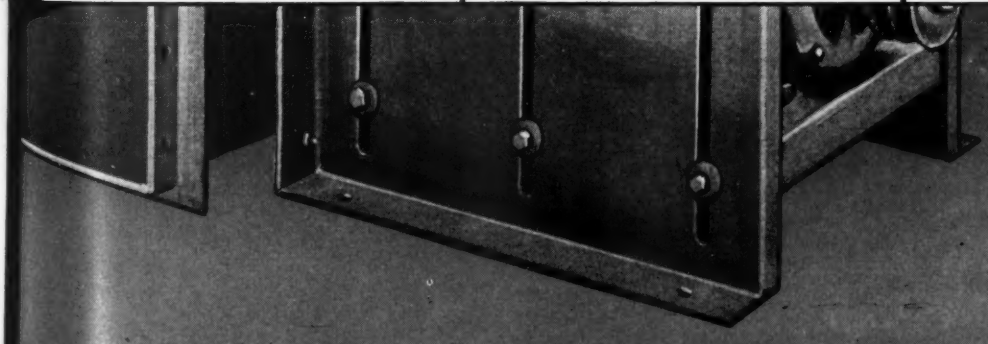

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What Every Consulting Engineer Should Know When

Dealing With the World Bank

STAFF REPORT

A CONSULTING ENGINEER was sitting in the lounge of the Engineers Club in San Francisco talking to several other consultants. "In Europe," he said, "every conversation I had with a consulting engineer seemed to bring up the subject of the World Bank. The European consultants seemed to think that since I was from the United States, I should know all about it. Many of them could not believe me when I said that I not only had never had a project through the World Bank, but I did not even know what it was."

This engineer sitting in his club in San Francisco, although not representative of all his colleagues in the United States, many of whom have been consultants on World Bank projects, was nonetheless typical of a great many American engineers who do not know of the Bank's work and who may wonder whether they are, for that reason, missing jobs.

It is probably true that the consulting engineers of the principal industrial countries of Europe know more of the World Bank than do many of their counterparts over here — and with good reason.

The World Bank, or the International Bank for Reconstruction and Development, as it is properly titled, was set up during the Bretton Woods Conference between the Allies, in 1944, and first opened its doors in June, 1946. This was immediately after World War II, and the financial condition of many of the great powers as well as the smaller countries was far from rosy. It was felt that a World Bank

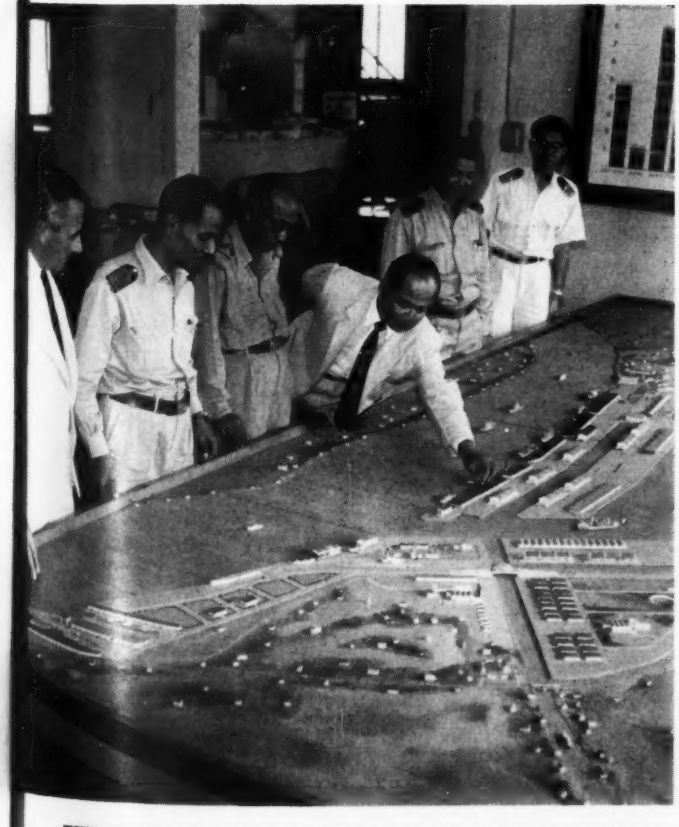
was needed to aid in reconstruction of the countries hurt by the War and in the development of the industrially backward nations.

Bank Funds

The initial capital of the Bank was supplied by its member nations — which now number 60. Nominally the capital of the Bank is over $9 billion, but 80 percent of this is not called, and the Bank actually has been able to use only about $1100 million from Government capital subscriptions. The rest of its loan funds have come from bond issues in the United States and in European financial centers and from its net income which now aggregates over $250 million.

Because of its great economic power, the largest subscriber to the Bank is the United States, with 34.27 percent of the total. The United Kingdom comes next with 14.03 percent, and the 58 other countries subscribe in various amounts down to Panama's $200,000, or less than .005 percent.

This, it would seem, is perfectly fair and above board, but it has proved capable of misunderstanding. For example, the average European interested in the Bank's activities tended to see it as a lending institution with its head office in Washington, D.C., and with the United States contributing the largest share to its capital. Also, the Bank's relationships with Wall Street and the United States banking and financial community are necessarily very close.



THE GENERAL ADVISOR AND FIVE THAILAND ENGINEERS STUDY MODEL OF BANK FINANCED PORT IMPROVEMENTS.

THIS LARGE CULVERT WALL IS PART OF A HIGHWAY SYSTEM FINANCED FOR COLOMBIA BY THE WORLD BANK.

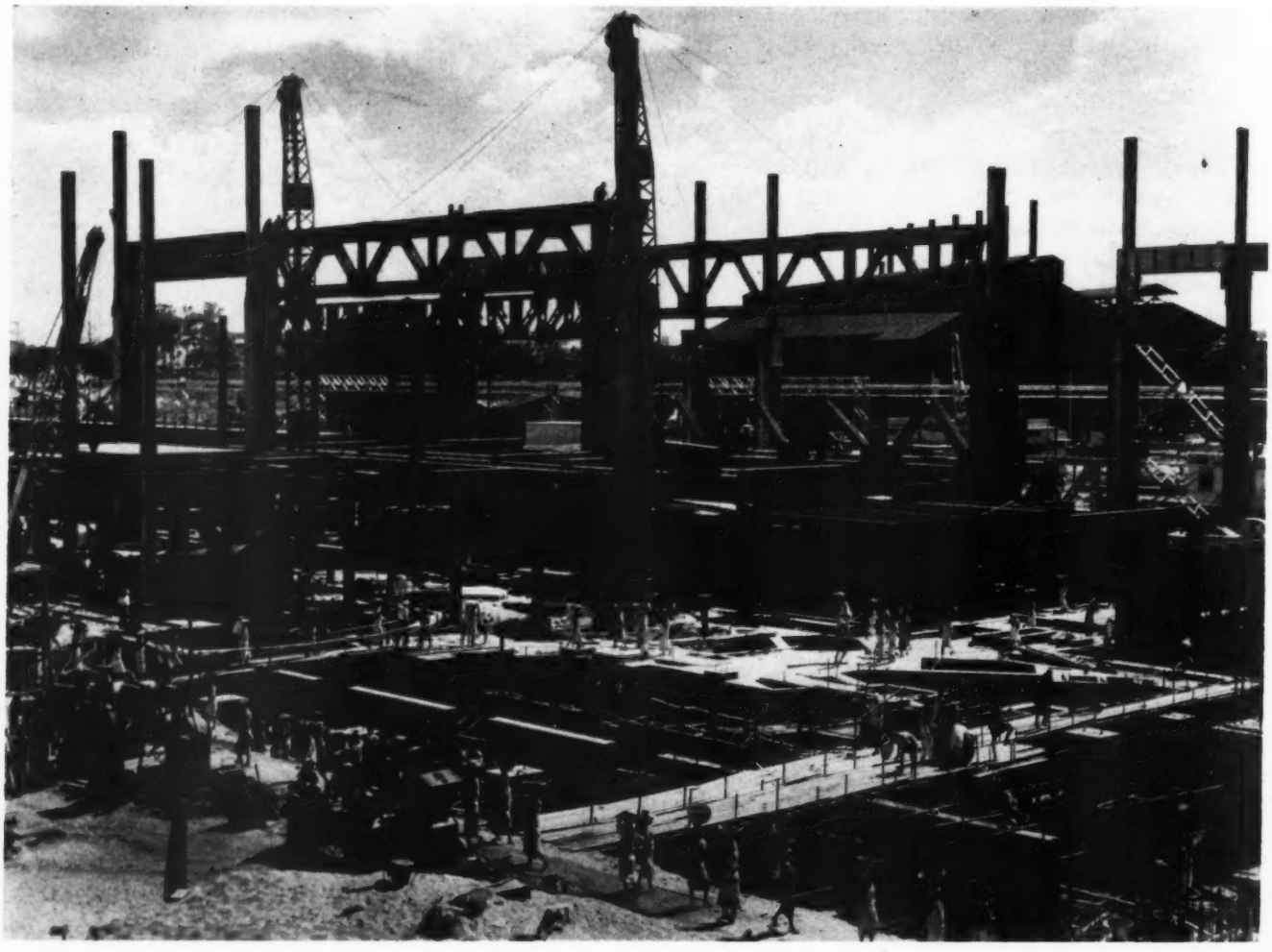
Consequently there arose in the minds of many European consulting engineers and contractors the idea that the World Bank, to which all nations contributed according to their means, might well increase the prosperity of the United States by channeling its expenditures to United States goods and services. This would retard the recovery of other nations and add to the already overwhelming power of the American economy. It looked to many Europeans, in fact, as though the World Bank was a fine example of a conspiracy of money interests in the United States to grow fat on other's meat.

The Europeans did not sit back quietly and brood over these suspicions. They expressed them openly and frequently — to such an extent that the World Bank, which knew that the charges were groundless, took steps to correct them.

Public Relations

The facts, up to mid-1956, show that 62 percent of all the Bank borrowers' expenditures on goods and services in the first 10 years of its operations had been in the United States. This, however, was a cumulative total, and as the European manufacturing countries recovered their competitive position the United States' proportion of the business fell. In 1955-56 she secured 50 percent of the business under Bank loans, the remaining half being split between European and Canadian suppliers, with Germany in second place, slightly ahead of the United Kingdom.

Armed with this information, the Bank sought to overcome its European public relations problem by agreeing to receive at its headquarters in Washington representatives of European manufacturers, bankers, contractors, and engineers for briefing sessions. These groups came by nationalities and were nominated by the professional and trade organizations of their home countries. It was explained to them that the Bank is a business institution, and as such it is interested in seeing to it that its borrowers make the best use of their money, especially since Bank loans are in foreign exchange. Beyond that,



LAST JUNE THE WORLD BANK LOANED $75 MILLION TO AID CONSTRUCTION OF THIS INDIAN STEEL MILL.

BANK MONEY ALSO FINANCED THE DIGGING OF NEW NAVIGABLE CHANNEL FOR MEUSE RIVER IN BELGIUM.

the Bank merely stipulates that purchases be made in one of its member countries, or in Switzerland which has a special relationship with the Bank. It is up to the borrower to make his own purchases of equipment or to secure the professional services he requires in connection with his project in accordance with the accepted customs of international bidding.

The Bank has lent a gross of over $3 billion to date, either to Governments or to large private enterprises, usually in basic industry, which have received the guarantee of their Governments. The great majority of the Bank's loans are for large projects costing anything from $10 million to $80 million. Over one-third of the Bank's loans, for example, have been for electric power development. It stands to reason, therefore, that the existence of these projects was well known, in the borrowing countries at least, some time before the Bank ever made a loan to help to finance them, and the consulting work on these projects already had been secured by consulting engineers whose intelligence

service had been sufficiently good to appraise them in time of the opportunities involved.

The visiting European engineers, therefore, were told that if they wanted business under Bank loans they could not look to the Bank for it, but only to the Bank's borrowers. Since the Bank cannot discuss projects publicly until it has made a loan, (by which time the main contracts for consultants and contractors may well have been firmed up) consultants have to find their own means of keeping aware of new projects under consideration.

European engineers who attended these briefing sessions (or who heard about them from those who did) found that they had learned a lot, including the fact that their suspicions that the Bank was a United States conspiracy were unfounded. To be sure, many American consulting firms have been used by Bank borrowers, but so also have many from the countries of Europe. What was perhaps more important, the visiting consultants learned of the emphasis that the Bank places on its borrowers using the services of qualified consulting engineers. Most of the Bank's borrowers are underdeveloped countries with inadequate technical resources. The Bank never ceases to point out that they can save themselves a lot of time and money by importing

TEN TYPICAL WORLD BANK PROJECTS

Country	*Loan*	*Brief Description of Project*	*Main Consultants During Preparation*	*Main Consultants During Execution*	*Major Contractors*
Burma	$5.4 m. of May '56	Rehabilitation and development of Burma's rail network.	Rendell Palmer & Tritton (U.K.)	Rendell Palmer & Tritton (U.K.)	Burma Railways (no contractors)
Ecuador	$8.5 m. of Feb. '54	Four-year road construction program to be carried out by the Highway Committee of the Province of Guayas.	Michael Baker Jr. (U.S.A.)	Michael Baker Jr. (U.S.A.)	Highway Committee and local contractors, except Daule Bridge by Ferrostaal (Germany).
El Salvador	$11.1 m. of Oct. '54	Completion of coastal highway from border of Guatemala to the Gulf of Fonseca on the Pacific.	Tippetts-Abbett-McCarthy-Stratton (U.S.A.)	Tippetts-Abbett-McCarthy-Stratton (U.S.A.)	Constructora El Aguila (Mexico), Maeri Construction (U.S.A.), Farnsworth & Chambers (U.S.A.), Johnson, Drake & Piper Overseas (U.S.A.), and local contractors.
El Salvador	$12.5 m. of Dec. '49	Construction of a 30,000 kw hydroelectric station on Lempas River near San Salvador.	Harza (U.S.A.)	Harza (U.S.A.)	J. C. Jones Co. (U.S.A.)
Iceland	$2.5 m. of June '51	Construction of hydroelectric plants located on the Sog and Laxa Rivers with capacities of 31,000 kw and 8000 kw respectively in the Reykjavik and Akureyri areas.	Berdal (Norway), Vattenbyggndsbyran (Sweden), Eggertson (U.S.A.), also local consultant on some civil engineering.	Berdal (Norway) and Icelandic State Electric Authority.	Fosskraft (Norway), & local contractors.
Pakistan	$13.8 m. of June '55	Construction of a 40,000 kw thermal station in Karachi.	Brian Colquhoun & Partners (U.K.); Handcock & Dykes (U.K.)	Brian Colquhoun & Partners (U.K.)	Local contractors.
Rhodesia & Nyasaland	$80 m. of June '56	Completion of first 500,000 kw stage of hydroelectric project on the Zambesi River at the Kariba Gorge.	Civil Engineers — Sir Alexander Gibb & Partners (U.K.), Coyne & Bellier (France), and Sogei (France), Elec. & Mech. Engineers, Merz & McClellan (U.K.)	Civil Engineers — Sir Alexander Gibb & Partners (U.K.), Coyne & Bellier (France), and Sogei (France), Elec. & Mech. Engineers, Merz & McClellan (U.K.)	Cementation Co. Impresit (Italy).
Peru	$2.5 m. of April '55	Construction of a cement plant of 100,000 metric tons capacity at Pacasmayo in Northern Peru.	Knowles Associates (U.S.A.)	Knowles Associates (U.S.A.)	MIAG (Germany)
Iceland	$854,000 of Aug. '52	Construction of an ammonium nitrate fertilizer plant in Reykjavik area with capacity of 18,000 metric tons.	Singmaster & Breyer (U.S.A.)	Singmaster & Breyer (U.S.A.)	Local contractors.
Chile	$20 m. of Sept. '53	Construction of Compania Manufacturera de Papeles y Cartones S.A. of a newspaper and pulp plant, each of 50,000 tons capacity, near Concepcion.	John Spangenberg (Sweden).	John Spangenberg (Sweden).	Local contractors.

the best advice available. This is not always palatable to the borrower, but it is medicine he has to swallow if he wishes to get a Bank loan.

It is ironic, therefore, that the American consulting engineer in his club in San Francisco should have caught the backwash of the Bank's information to European consultants and should have drawn from it the conclusion that the American consulting engineer was missing out on Bank business!

The Bank's Relations with Consulting Engineers

In fact, as will be clear from what has already been said, the Bank not only does not hire consultants for its borrowers; it does not even maintain a list of "approved" consulting engineers. The reasons for this are obvious. The Bank would find it impossible to provide a borrower with a list without providing so many alternative names as to make it useless. Moreover, the Bank quails at the thought of trying to keep any list of consulting engineers up to date.

The Bank's procedure is to ask its borrowers to select their consulting engineers in the normal way, by using their own contacts or their Embassies abroad so as to find firms competent to work on a particular project. In very exceptional cases a borrower may be in such a position of ignorance about a certain type of project as to require extraordinary assistance. In that event the Bank might provide lists—reluctantly—but these would contain several names from several countries. It is stressed, however, that any such action would be very much the exception rather than the rule.

Naturally the Bank must be satisfied with the borrower's selection of a consulting engineer. As a lending organization the Bank is interested in seeing to it that its money is used wisely and that its loan is repaid. The Bank feels that a good consulting engineer on the job is part of wise spending—a very important part. Therefore it reserves the right to refuse to disburse a loan unless the goods and services chosen are acceptable. It is rare for the Bank to reject a consultant chosen by a borrower but such things have been known to happen; for example, when some official of a borrowing country feels it would be a good idea to have a friend or his brother-in-law set up a consulting engineering firm and collect a fee!

This duty on the part of the Bank to vet the consultant hired by the borrower involves the Bank in the collection of a great deal of information on consulting engineers all over the world, their size, experience, field of work, the territories in which they have operated, and so on. It can certainly do no harm for any American consulting engineer to compile and send to the World Bank up-to-date information about the qualifications of his firm. But this information, which already fills several filing cabinets in the World Bank, can in no sense be regarded as a list of approved consultants. It is merely one guide that the Bank can use when the time comes for it to pass judgment on the qualifications of the consultant selected by its borrower.

Good banking practice demands that every proposed loan be investigated by the Bank to see if the project is economically sound and technically feasible. So the Bank itself sometimes hires engineering consultants when its own small staff of experts is fully occupied elsewhere, or when the knowledge required lies outside the experience of the Bank's own engineers. In such cases the Bank employs consultants on a fee basis and on the understanding that those so employed are disqualified from taking any further part in the project.

W. A. B. Illif, Vice President of the Bank gave an example of this use of consultants by the Bank in a recent talk before the Engineers Joint Council.

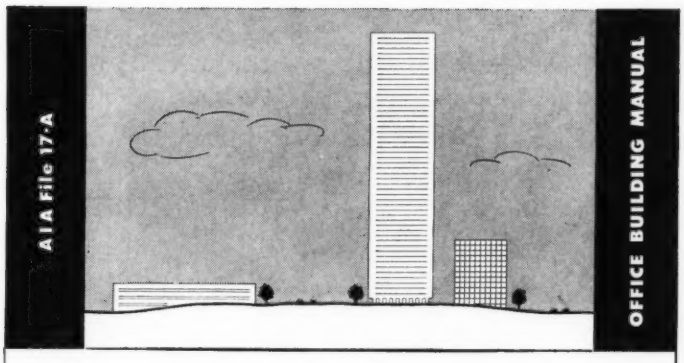
"A usually more difficult problem for us is the problem of judging the economic worth of a project. Take Kariba . . . as an example. The plans for Kariba were as expertly prepared as any that have ever been submitted to us. But we still felt we had to check the data we received estimating the potential power market in the territories that Kariba is designed to serve . . . To check the prospective market for Kariba power, the Bank, to save time, hired its own consultant — an American firm with experience in this kind of power market study in the underdeveloped areas of the Southwestern States . . . The up-shot was a final market estimate which actually exceeded by a bit the estimate given by the borrower in his own justification."

Need More Help

The Bank is not only willing to hire consulting engineers for this type of preliminary study, but they cannot find as many qualified engineers as they would like. Mr. Illif went on to state that engineering firms are in a position to provide help to the Bank and that more engineering firms are needed for this work, but "engineering firms must be willing to staff themselves appropriately if they are to carry out these broader tasks. More frequently than we like, we find that consultants prepare reports which are too limited in scope to meet the requirements of particular investment situations."

It is unlikely that the average U.S. engineering firm, with a total staff of about 30, could hope to be selected by a borrower as engineer for a typical Bank loan project, which usually runs into $10-20 million. Only the large firms can afford the manpower for projects of that size. But the average firm or even the very small firm could be used by the Bank for the preliminary investigations and reports. These are sometimes handled by just one man hired as a special consultant.

Assume, however, that a firm is large enough to feel that they can handle one of these projects — a



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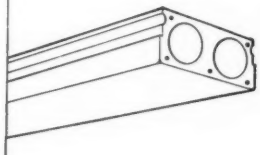


ELECTRIFIED
CELLULAR CONCRETE FLOORS

How to Electrify Precast Concrete Floors

This new manual on Flexicore Electrified Floors is for architects, engineers and contractors.

It gives the architect the overall picture on the use of this system in a one-story, two-story or multiple-story office building, including savings in fireproofing, construction time and materials.

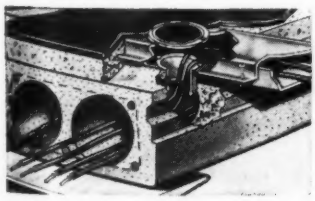
It gives the structural engineer design information on the framing for Flexicore long-span construction, plus typical structural details and a design example.

It gives the electrical engineer specific detailed information about this underfloor electrical distribution system, and includes typical distribution layouts.

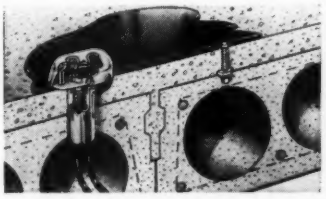
It shows the electrical contractor the step-by-step installation of Conduflor electrical fittings with photographs.

It gives the general contractor information he needs to handle a Flexicore electrified job.

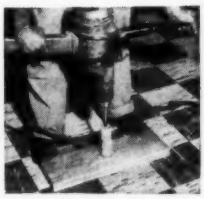
For a copy, write or phone your nearest Flexicore manufacturer, or The Flexicore Co., Inc., Dayton 1, Ohio.



Wiring drops from header duct into cell at handhole junction.



Wiring then runs either way through cell to floor outlet.



To install outlet: drill hole at outlet location.

Next, install fitting in floor and fish wire.

Last, attach electric or telephone outlet box.

flexicore® ELECTRIFIED FLOORS
with Conduflor® ELECTRICAL FITTINGS

ALABAMA, Birmingham 1
The Alabama Cement Tile Co.
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ILLINOIS, Chicago, Franklin Pk.
Mid-West Concrete Pipe Co.
INDIANA, E. Chicago, PO 539
Calumet Flexicore Corporation
MICHIGAN, Livonia, PO 2006
Price Brothers Company
MINNESOTA, St. Paul E-4
Molin Concrete Products Co.
MISSOURI, St. Louis Flexicore
PO Box 552, Collinsville, Ill.

NEW JERSEY, Camden
Camden Lime Co.
NEW YORK, Buffalo 6
Anchor Concrete Products, Inc.
NEW YORK, New York 17
Flexicore Precast Inc.

NORTH CAROLINA, Lilesville
W. R. Bonsal Company, Inc.
OHIO, Akron-Cleveland
Lake Erie Flex., Kent, Ohio
OHIO, Columbus 22
Arrowcrete Corporation

OHIO, Dayton 1, PO 825
Price Brothers Company
PENNSYLVANIA, Monongahela
Pittsburgh Flexicore Company
RHODE ISLAND, Saylesville
Durastone Flexicore Corporation

TEXAS, Houston, 4511 Kyle St.
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WEST VIRGINIA, Wheeling
Universal Concrete Pipe Co.
WISCONSIN, Beloit, PO 325
Mid-States Concrete Products Co.
CANADA—Toronto, Ontario
Murray Associates, Limited
CANADA—Montreal, Quebec
Creaghan & Archibald Ltd.
CANADA, Woodstock, Ontario
Schell Industries Ltd.
CANADA, Supercrete Ltd.
St. Boniface, Man.; Regina, Sask.
PUERTO RICO, Rio Piedras
Flexicore Co. of Puerto Rico

harbor development, a large hydro plant, a network of roads, or a canal system — how does it go about getting the job? Since the Bank will not recommend a particular firm, there is no use going to the Bank. The answer is to go to the client.

A consulting engineer interested in getting work on these projects must, therefore, be smart enough to find out about them before they have reached the stage of a negotiated loan. The only way to do this is through information from the countries concerned; contacts must be established with them and with their Embassies. This is hardly the type of reconnaissance work for small firms but the small firm does not actually want these huge jobs.

The International Finance Corporation

Fortunately for the small engineering firm, there recently has been organized the International Finance Corporation, headed by Robert L. Garner, who had been a Vice President of the World Bank since 1947. This organization was set up to further economic development, particularly in the less developed countries, by encouraging the growth of productive private enterprise. (See "More Money for Private Enterprise Abroad," by Ray C. Burrus, CONSULTING ENGINEER, December 1956). While the World Bank loans only to governments or requires government guarantee of loans, the IFC will invest directly in productive private enterprise, in association with private investors, in underdeveloped countries without any kind of government guarantee.

Briefly, IFC will invest in association with either local or foreign private investors, or both, for establishing or expanding private enterprises. IFC will expect the private investors to put up more than half of the capital required for the enterprise, and IFC will look to the senior partners to provide the management to conduct the business of the enterprise. In its early years IFC expects that most of its investments will be in partnership with U.S., British, and European firms who wish to establish or expand a foreign operation. IFC will invest only in projects located in its member countries.

The IFC is newly organized and has not as yet made any investments. But a number of promising proposals now are being considered.

It can be seen that the small and the medium size consulting engineer could fit nicely into this set-up. Most IFC investments will be for much smaller amounts than those of the World Bank projects — in the initial stages, IFC wants enterprises of at least $500,000 where IFC participation would be $100,000. They will be the size loans needed to set up a lighting fixture plant in India, a textile mill in Africa, or a foundry in some South American country. This is the size of project handled frequently by small and medium size consulting firms.

Again, the IFC, like the World Bank, is not interested in recommending particular firms of consulting engineers, and since there will be partners on each of these loans who are now operating in one of the industrial nations, there seldom will be an instance in which the IFC will deal with a borrower who is unfamiliar with the function of consultants. In almost every instance, the partner will have used consulting engineers before and will have a knowledge of how engineers should be selected.

In examining a prospective investment, if IFC feels it should investigate some of the key points, it will employ consultants. IFC will make use of the World Bank's files of background information when ever they need to know about particular firms.

Need for Consultants

IFC is as convinced as the World Bank of the need for their borrowers to use independent consulting engineers in order that they may get the best use of the money spent. Mr. R. L. Garner, President of IFC, brought out the attitude of his organization clearly when he recalled this experience. The president of a large U.S. manufacturing organization called on him and explained that the Bank and the IFC could save their borrowers the cost of the engineering fee by making use of the "free engineering" that could be provided by the excellent engineering staff of his company. Mr. Garner was not impressed. He said to the gentleman, "Mr. ————, you are the president of a large company. In holding that position I judge that you are conscious of your responsibilities and recognize that the welfare of your company is your prime responsibility. That is as it should be. The firm we want to do the engineering for our borrowers must be responsible first to that borrower. Furthermore, I am perfectly aware that there is no such thing as 'free engineering.'"

That is an excellent statement to come from the president of an investing organization. It indicates an understanding of the professional position of the consulting engineer and his duty to his client.

Today, the World Bank, with its ten-year's experience, is making sure that its borrowers get good technical assistance on all projects for which they make loans. The IFC is following the policies found successful by the Bank. Meanwhile, the European engineers seem to have been satisfied to the extent that they no longer feel that the Bank is a conspiracy to fatten American firms with European money.

While U.S. engineers have been less well informed about the activities of the Bank, a list of engineers on these projects indicates that Americans are getting at least a fair share of the business. Furthermore, when the IFC starts making loans, there will be many American manufacturers acting as partners of the private enterprise groups in the underdeveloped countries, and it is most likely that these American firms will want American consulting engineers doing the design and supervising the construction of the new plants. ▲▲

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INDIANA TURNPIKE ILLUSTRATES THE TYPE OF CONSTRUCTION NEEDED UNDER THE FEDERAL HIGHWAY PROGRAM.

An Engineer takes a look at . . .

Federal Highway Legislation

FRANK H. JACKSON, Engineering Consultant

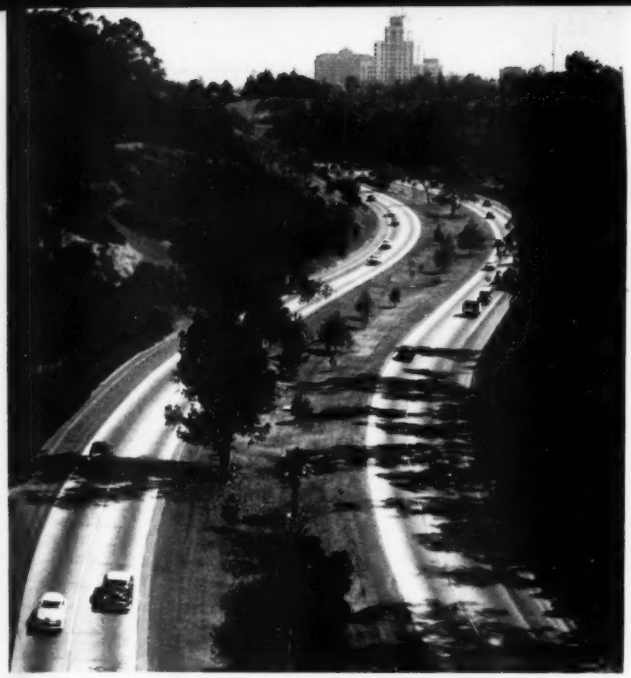
Mr. Jackson, an engineering consultant, retired from government service in 1952 after serving 47 years with the Bureau of Public Roads. At the time of retirement he was Supervising Physical Research Engineer in charge of Non-Bituminous Material investigations. He has held offices and worked actively on committees in ACI, ASTM, Federal Specifications Board, and AASHO. He was awarded the ACI Wason Medal, the Highway Research Board's Distinguished Service Award, and the Department of Commerce Distinguished Service Award. He has recently been acting as consultant to The Master Builders Co. on special highway problems.

CE exclusive

DURING THE NEXT 13 YEARS the Federal Government will spend approximately $33 billion for the improvement of roads on the Interstate Highway System of the United States. This vast program, far exceeding in magnitude anything that has ever been attempted previously, will present a distinct challenge to the engineering profession to provide the many services that will be needed before even a start can be made on actual construction. Such services include engineering surveys, the design of structures, the preparation of plans and specifications, and cost estimates.

States Need Consultants

In order to provide these services to take care of the expanded highway program, it will be necessary for the States either to expand greatly their existing highway departments by the employment of additional designers, specification writers, estimators, and draftsmen, or to increase substantially their use of engineering consultants. That the latter course has proved to be both efficient and economical is shown by the relatively large number of States that are already utilizing the services of engineers in private practice. A survey made by CONSULTING ENGINEER (Nov. 1956) showed that of the 43 states answering the inquiry, 37 now do, or would, utilize outside consultants. It seems reasonable to assume, therefore, that the demand for qualified consultants in the highway field will increase significantly. Furthermore, since almost all of the work will be on the important roads of the Interstate System, the proportion of major structures such



CABRILLO FREEWAY, SHOWN HERE NEAR SAN DIEGO, IS TYPICAL OF TYPE OF HIGHWAY THE U.S. NEEDS.

as bridges and grade separation structures will be relatively large. It is these major projects, with their difficult design problems, that the States usually place in the hands of engineering consultants for execution.

The Federal-Aid Highway Act of 1956, approved by the President on June 29, is actually an amendment to the original Federal-Aid Highway Bill which was passed by Congress in 1916. The original bill recognized, for the first time, the joint responsibility of the States and the Federal Government in the highway field, and thus became a milestone in the history of road building in this country. The original bill also established the formula for allocating highway funds on the equal basis of area, population, and road mileage—with the States required to meet the Federal contribution on at least a 50-50 basis. The responsibility for preparing plans and specifications as well as for the location, design, and construction of the roads, also rested with the States, the Federal Government reserving the right to approve or disapprove specific projects before allocating funds.

The New Formula

In spite of the numerous amendments to the original bill, which have been adopted from time to time since its passage 40 years ago, the historic formula governing the distribution of Federal funds has, with one exception, remained unchanged until the present year. The one exception was the granting of Federal funds on a 100 percent basis to increase employment during the 1931 depression—the so-called PWA program. In the new Federal-Aid Highway Act of 1956, the Congress changed the ratio of Federal to State participation on the new Interstate System from the old 50-50 Federal-Aid basis to a 90-10 basis; that is, the Federal Government to pay 90 percent of the cost and the State 10 percent. The current bill also changes the method of apportionment on the Interstate System so as to give considerably more weight to population than

HEAVILY TRAFFICKED RT 313 IN MARYLAND HAS BEEN IMPROVED, BUT IT STILL REMAINS A TWO-LANE ROAD.

THIS MIGHT HAVE BEEN YOU LESS THAN 40 YEARS AGO. IT TOOK A LONG TIME TO GET OUT OF THE MUD.

NOT UNTIL THE 30'S DID RELATIVELY MODERN EQUIPMENT (LOWER RIGHT) FINALLY IMPROVE CONDITIONS.

was provided under the old law. This change places New York State at the head of the list insofar as total Federal grants are concerned rather than Texas, which formerly headed the list.

The Early Days

From the very beginning the responsibility for administering the Federal-Aid Highway Laws has been vested by Congress in the Bureau of Public Roads. The forerunner of the Bureau was the old Office of Public Road Inquiries, which was authorized by Congress, in 1892, as a very minor unit in the U. S. Department of Agriculture. The entire function of this small unit was the collection and dissemination of information, principally to farmers, concerning the best methods of building rural roads. The emphasis was on getting out of the mud. The office was granted $10,000 yearly for this purpose, none of the money to be spent for actual construction. In 1900, the work of this office was expanded to include the building of so-called "object lesson roads" with local funds but under the supervision of a Federal engineer. These local demonstration roads were of great value in providing guidance in the proper selection and use of materials and construction practices. This initial step in the matter of Federal-State relations was very helpful in laying the groundwork for the much broader cooperative effort which was to follow.

The year 1900 also saw the establishment of the first government road materials testing laboratory. It was started by L. W. Page, one of the pioneer road builders of this country, as a small unit in the U. S. Department of Agriculture, with only five employees. Its sole function, aside from a very small amount of bituminous testing, was the testing of rock and gravel for use as road surfacing materials. Contrast this with the present physical research organization of the Bureau with its 110 employees and extensive plant in Virginia, just across the Potomac River from Washington. This organization currently is engaged in research in every field of highway engineering, including soils, materials for concrete and bituminous construction, rigid and flexible pavement design problems, drainage problems, and many others. The data and conclusions from this work are released periodically, usually through the monthly magazine *Public Roads*. It would seem quite safe to say that the Bureau of Public Roads, through its research activities, has contributed more towards our understanding of how to use the highway dollar effectively than any other single agency, public or private.

Amendments

During the 40 years following the passage of the original highway bill, the act has been amended by Congress many times. Most of these amendments

THE PHOTOGRAPH AT TOP WAS TAKEN JUST THREE YEARS AGO. THIS IS IN CARROLL COUNTY, MD.

were made either to correct weaknesses in the original act or to meet the challenge of changing times. For example, the original bill was silent as to the location of the roads to be eligible for Federal aid. The political potentialities of such an arrangement are apparent. The omission was corrected, in 1921, by an amendment which required that each State designate up to 7 percent of its total road mileage to be known as the Federal-Aid System; these roads to connect, insofar as possible, at State boundaries. The use of Federal funds was to be limited to this system. This was the first step in the development of a truly interstate system of highways. Another amendment, also adopted that same year, required that each State establish a highway department to administer the expenditure of Federal funds. Up to this time only about two-thirds of the States were adequately equipped in this respect.

More Recent Changes

Several important amendments to the original bill were adopted in 1934. One of these, the Hayden-Cartwright Act, was effective in stabilizing the highway construction industry by requiring advance planning of projects. Another provided that up to 1½ percent of a State's allotment could be used for preparing plans and specifications and for conducting research. It was in this way that money was provided for the highway planning surveys conducted by the various States, the results of which were used so advantageously by the Bureau of Public Roads in preparing its recent report to the Congress on the highway needs of the nation.

Still another amendment, passed in 1934, required that Federal allotments be withheld from any State that diverted its highway revenues to non-highway uses. This had the effect of stopping some States

THIS IS THE WAY COLUMBUS ST., BELLEFONTAINE, OHIO, LOOKED IN 1923, WHEN STREET WAS LAID.

HERE IS THE SAME STREET 33 YEARS LATER. THE STREET'S THE SAME—TRAFFIC IS SOMETHING ELSE.

THIS HIGHWAY SEPARATION IN LOS ANGELES POINTS THE WAY TO SOLUTION OF THE CONGESTION PROBLEM.

from using their gas tax revenues for school or other non-highway purposes. At that time there was a very strong feeling that motor vehicle taxes be used only for building roads. The general attitude at the present time is, of course, quite different. Most of the States now divert to other uses at least a portion of their motor vehicle tax revenues, the percentage varying from less than one percent in one State to as high as 47 percent in another.

Primary and Secondary Systems

Two far reaching amendments were adopted in 1944. One of these provided for the designation of two systems of Federal-Aid roads, one to be known as the Primary System and the other as the Secondary System. These combined systems now total about 750,000 miles, or about 1/5 of the total road mileage of the Nation. About 1/3 of this mileage is on the Primary System; the balance on the Secondary System.

The other amendment provided for the establishment within the Federal-Aid Primary System, of the so-called National System of Interstate Highways, a 40,000-mile network of the most important roads in the nation.

Finally, this year, Congress authorized, through the Federal-Aid Highway Act of 1956, the expenditure of approximately $33 billion for road construction during the next 13 years. This total includes, in addition to the $25 billion authorized for the Interstate System, the regular Federal-Aid allotments to cover authorizations previously made or those reasonably expected to be made in the near future.

The $33 billion authorized by Congress, although large in terms of previous allotments, is only about 1/3 of the amount which the Bureau of Public Roads estimated would be necessary to adequately care for the traffic requirements of the Nation during the next 10 years. Under the law almost all of the amount that has been allowed must be spent on the Interstate System, so improvement of the 200,000 miles of the Primary System outside the Interstate System will be delayed. The same is true of the 500,000 or so miles of road comprising the Secondary System. However, the emphasis has been placed by Congress on the necessity for completing the most important roads first — for both economic and military reasons. These critical highways are almost all on the Interstate System, which, although it comprises only about one percent of our total road mileage, carries over 15 percent of all traffic, connects 42 of the 48 State capitals, and directly connects 90 percent of all cities having a population of 50,000 or more. The system is an extremely important segment of our highway plant, and it should be brought up to required standards as soon as possible.

The intent of Congress in this regard is very clear. In the 1956 act it is stated that "it is the intent of the Congress that the InterstateSystem be completed as nearly as practicable over a 13-year period and that the entire system in all the States be brought to a simultaneous conclusion."

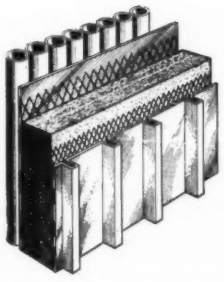
AASHO Standards

Anticipating the need for uniform standards of design to govern the Interstate System, the American Association of State Highway Officials has developed a set of geometric design standards, which were approved by the Bureau of Public Roads on July 17 last. These standards set up criteria, based on estimated traffic in 1975, to govern various design features such as right-of-way widths, lane widths, number of lanes, degree of access permitted, design speeds, curvature, and sight distances. The Bureau estimates that about 83 percent or 33,000 miles, of the Interstate System will be 4-lanes or better divided highway with 2-lane highway sufficient for the remaining 7000 miles until 1975. Contrast this with the fact that in 1950 there were less than 3000 miles of divided highway in the entire country. Also, when one realizes that all of these roads will be of the very best type, that is, either concrete or bituminous pavement and that numerous major bridges and grade separation structures are involved, the magnitude of the task, even when spread over a 13-year period, becomes apparent.

Can It Be Done?

Inevitably, questions will be raised as to the feasibility of such an operation from the standpoint of available manpower, materials, and equipment to do the job. Will a sufficient number of trained engineers be available to plan and supervise the construction of such an operation? Will the producers of cement, asphalt, aggregates, and other materials be able to supply the demand, particularly the initial demand and, finally, will the equipment manufacturers be able to supply the additional amount of heavy equipment needed to get the program under way without delay? These questions are considerably more pertinent with respect to the $101-billion program originally proposed by the Bureau of Public Roads than to the curtailed program finally approved by Congress this year. However, even a $33-billion program may justify a question or two along this line.

In an attempt to answer these questions, the American Road Builders' Association, in cooperation with the Bureau of Public Roads, last year initiated a series of capacity studies, the purpose of which was to ascertain the ability of the industry to properly execute a public works program involving the continuous expenditure of several billions of dollars per year over a 10-year period — a program far exceeding anything previously attempted anywhere. The work was performed by four task forces to which were assigned the following

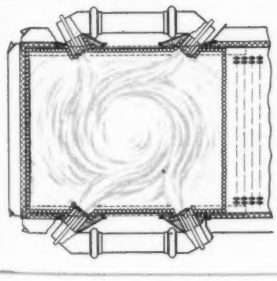


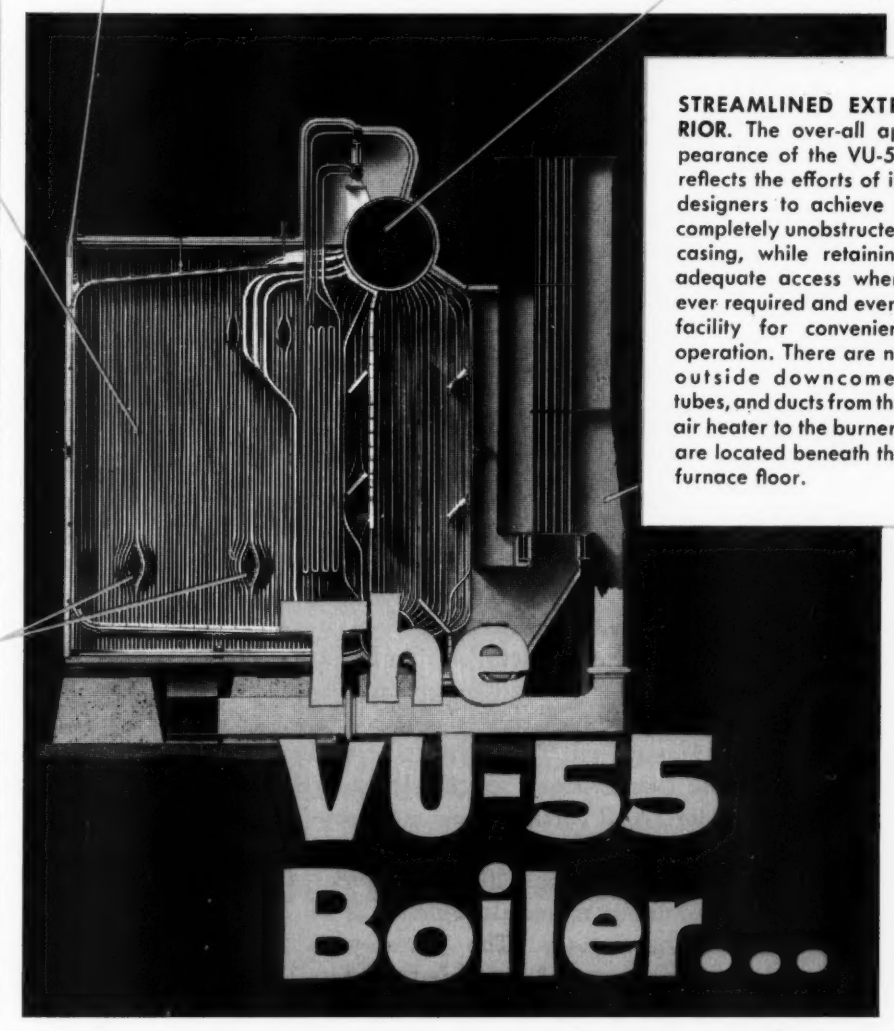
DOUBLE WALL, PRESSURE-TIGHT CASING. The latest development in casing construction for pressure firing of boilers in the size class of the VU-55, this casing is designed to assure life-time tightness with minimum heat loss. Pressure firing permits the elimination of an induced draft fan with its attendant operating and maintenance costs. Construction consists of tangent tubes backed up successively by welded steel panels, 4 inches of high quality insulating material and an outer steel casing formed as shown to provide adequately for expansion and assure ample strength. Low heat loss and the tightness required for pressure firing are assured by this double-wall construction.

HIGH STEAM QUALITY. Equipped with a large (60-in.) steam drum, the VU-55 has generous water capacity and steam reservoir space. C-E drum internals assure high quality steam at all ratings.

TANGENT FURNACE TUBES. The VU-55's furnace tube arrangement provides complete heat-absorbing, water-cooled protection on all furnace walls. Furnace maintenance is minimized, refractory expense is eliminated, heat absorption rates per sq. ft. are higher.

TANGENTIAL FIRING. More than 20 years of application experience have established the exceptional advantages of tangential firing. About 90 per cent of Combustion's large utility installations use this advanced method of firing. Flame streams from the four burners impinge upon one another at high velocity, as shown, creating a turbulence unattainable by any other method of firing. The result is rapid and complete combustion. As the gases spiral upward, they sweep all furnace heating surfaces, assuring a high rate of hect absorption.





STREAMLINED EXTERIOR. The over-all appearance of the VU-55 reflects the efforts of its designers to achieve a completely unobstructed casing, while retaining adequate access wherever required and every facility for convenient operation. There are no outside downcomer tubes, and ducts from the air heater to the burners are located beneath the furnace floor.

The VU-55 Boiler...

Custom Features, Standard Sizes, Advanced Design

The VU-55, newest of the C-E line of Vertical Unit Boilers, represents the closest approach to central station performance yet achieved in standardized boilers in its capacity range.

Its design combines a number of time-tested and service-proved features, such as Tangential Burners, double wall, pressure-tight casing, and tangent furnace tubes. In addition, this bottom-supported unit requires no outside supporting steel, is economical of space and streamlined in appearance.

It is available in 5 sizes for capacities from 50,000 to 120,000 lb per hour. It is designed for 3 pressure ranges (250, 500 and 750 psi) and can be equipped with a superheater to provide temperatures up to 750 F. Either a tubular or a regenerative air heater is available.

The VU-55 Boiler is symmetrical in design, performs efficiently over a wide range of output, and is easy to operate and maintain.

It is, in fact, the boiler with the custom features and the advanced design.

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all types of steam generating, fuel burning and related equipment; nuclear reactors; paper mill equipment; pulverizers; flash drying systems; pressure vessels; soil pipe.

subjects: (1) planning and design, (2) materials and supplies, (3) construction, and (4) machinery and equipment. The Report appeared as an ARBA bulletin, published in April of 1956.

The conclusions reached by the ARBA experts were very interesting. They concluded that not only could the industry support a program at the $100-billion level but that even an immediate program at a substantially higher level could be supported. The report also showed that the availability of engineering services is now and for some time would continue to be the controlling factor. In other words, engineers are more scarce than either materials, contractors, or equipment. However, the report further emphasizes that, even granting a relative shortage in engineers, there is still ample capacity in all categories to complete on schedule the $33-billion program authorized by Congress.

What Consultants Can Do

The ARBA report emphasizes the fact that competent and experienced consultants are available to assist in the preparation of project plans and specifications, with particular reference to those major projects that involve complicated features of design. It is in connection with this class of work that consultants can best contribute to the planning and design of the expanded highway program.

The ARBA experts spoke only of supply. They said nothing about quality of materials or workmanship. They undoubtedly assumed that, in executing this tremendously accelerated program, the traditionally high standards of the road building industry would be maintained. The question is, will they be maintained? Let us take a specific example, the category of materials. It certainly seems reasonable to assume from the ARBA report that the industry can produce the huge quantities of cement, aggregates, and bituminous materials which will be required to build these roads. The question is whether, under the pressure of expanded production, there will be any tendency to chisel just a little on quality. It may be of interest to explore for a moment this phase of the problem.

During the next 10 years the road building industry will be operating in a sellers' market, that is, there will be a tendency all along the line for demand to exceed supply. This tendency will be nationwide although it probably will vary somewhat in different parts of the country due to local or spot shortages, such as the spot shortages in the supply of portland cement that occurred during the past two or three years. The ARBA report indicates that there will continue to be spot shortages in this commodity until the industry is able to increase its capacity to meet the increased demands. At the present time the capacity of the cement industry is about 300-million barrels a year, and plans are being made to increase this by at least 25 percent.

There also will be local shortages in the supply of aggregates due to the depletion of existing supplies and the difficulty of locating replacements. The high cost of transportation makes the aggregate problem largely a local one. In other words, it is usually a matter of locating a new aggregate source in the same general area as the source to be replaced. At the present time, according to the ARBA report, intensive efforts along this line are being made, particularly in those areas where shortages exist.

The matter of an adequate supply of bituminous materials seems to present no problem. Inasmuch as the supply of asphalt, road oil, and tar is controlled almost entirely by the demand, it will be a relatively simple matter to adjust the production of such materials to meet the needs of the new program. The same is true of many other materials.

If past experience is any guide, there will be a tendency during this period of expanded production for some manufacturers to let down just a little on their manufacturing controls for the sake of increasing output. This might result in an increase in the amount of substandard or borderline materials coming on the market. By the same token, there could be a tendency for some engineers to relax their requirements somewhat and to accept materials that would be rejected under normal conditions. The pressure to accept borderline materials is frequently very great, and this pressure does not all come from the manufacturers, particularly when the product in question is in short supply or rejection would mean holding up the job. It should not be inferred that this practice will become general. Far from it. However, if history repeats itself, as it has a habit of doing, there will certainly be a tendency in this direction, and it is against this tendency that a warning should be sounded, both to the producers of materials and to the engineers who are responsible for the acceptance and use of these materials.

A Job That Must Be Done

It is easy to say that we need more and better roads. Everyone agrees that we do. For several years now the betterment of our highway system has lagged far behind the manufacture of the cars and trucks that make more and better roads so necessary. It is going to take time and a lot of money to catch up. However, it is a job that must be done and the sooner we tackle it the better. As Mr. McDonald, formerly Chief of the Bureau of Public Roads, was so often fond of saying: "We pay for good roads whether we have them or not and we pay more if we do not have them than if we do."

Congress, through the authorizations carried in the Act of 1956, has made it possible for us to make a good start on this job of modernizing our highway plant. It is up to us to do the rest. I am sure that we will measure up to our responsibility. ▲▲

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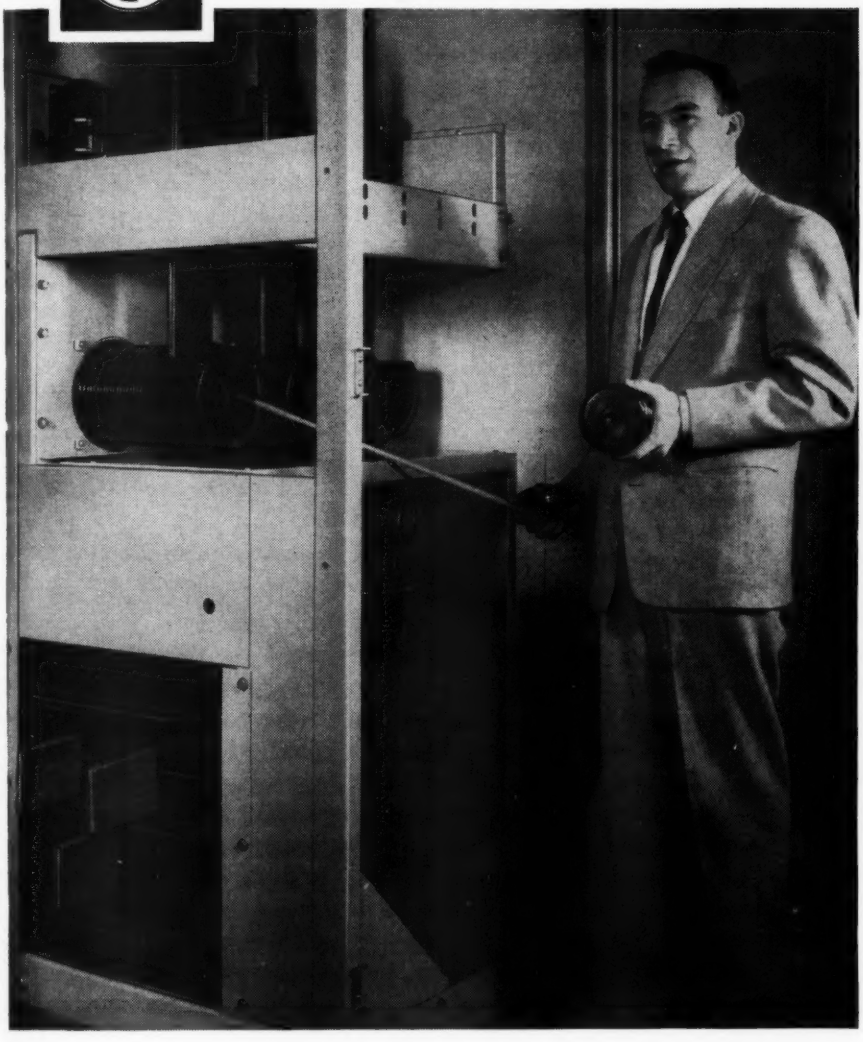

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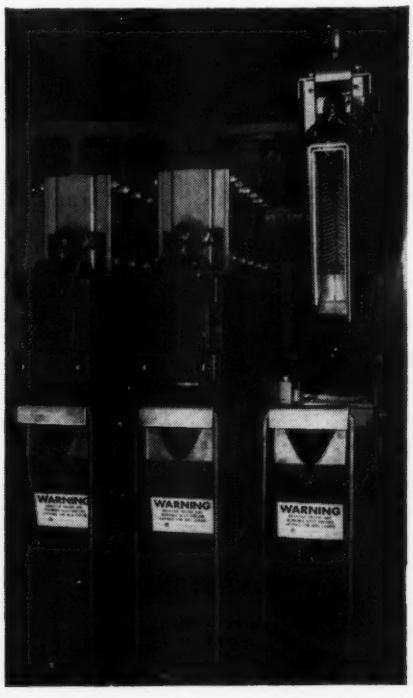

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A Consultant's Appraisal of

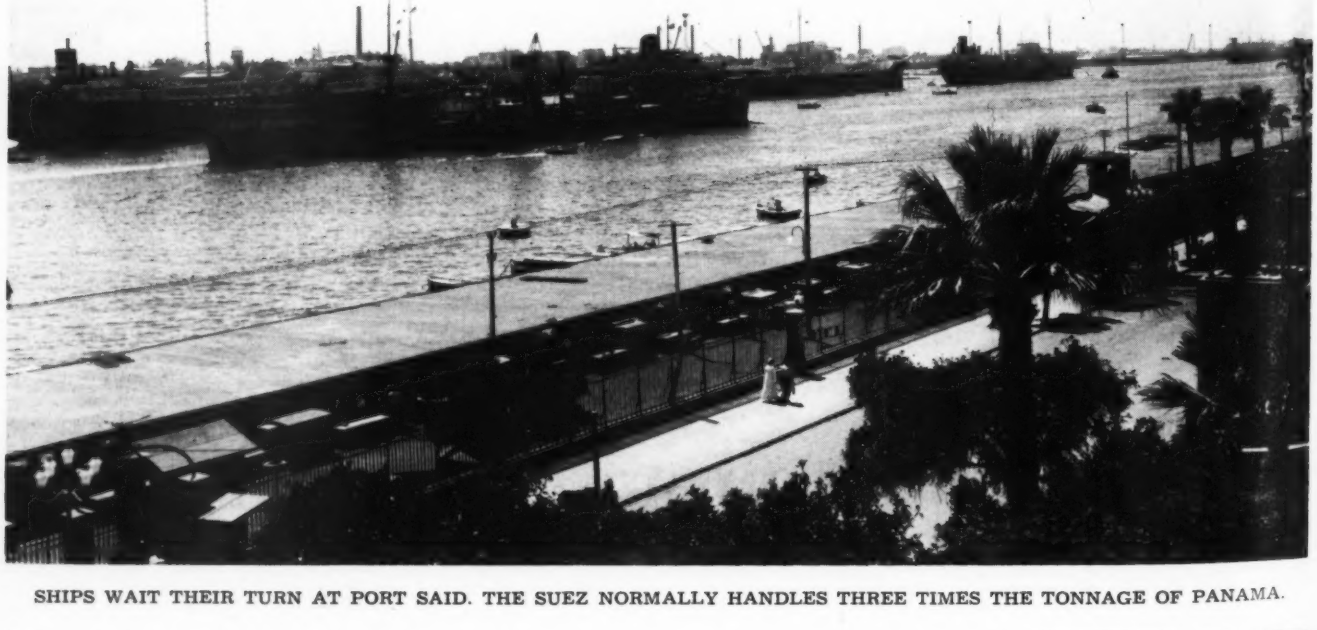
Engineer De Lesseps and the Suez Canal

AS THE SALVAGE VESSELS begin to clear away sunken ships in the Suez Canal, the world anxiously watches this Near East trouble spot — an area that would be of little international importance had it not been for the work of a brilliant French engineer. Ferdinand Marie de Lesseps, a diplomat as well as an engineer, first conceived of a sea-level canal through the Isthmus of Suez when he was sent to Alexandria as vice consul. He was only 27-years old in 1832, when he first seriously considered the project. A pestilence was raging over Egypt and de Lesseps was quarantined in what he described as a "repulsive lazaretto." He spent his time studying an engineering report prepared for Napoleon, became convinced of the feasibility of the plan, and proceeded to interest his friend, the Viceroy.

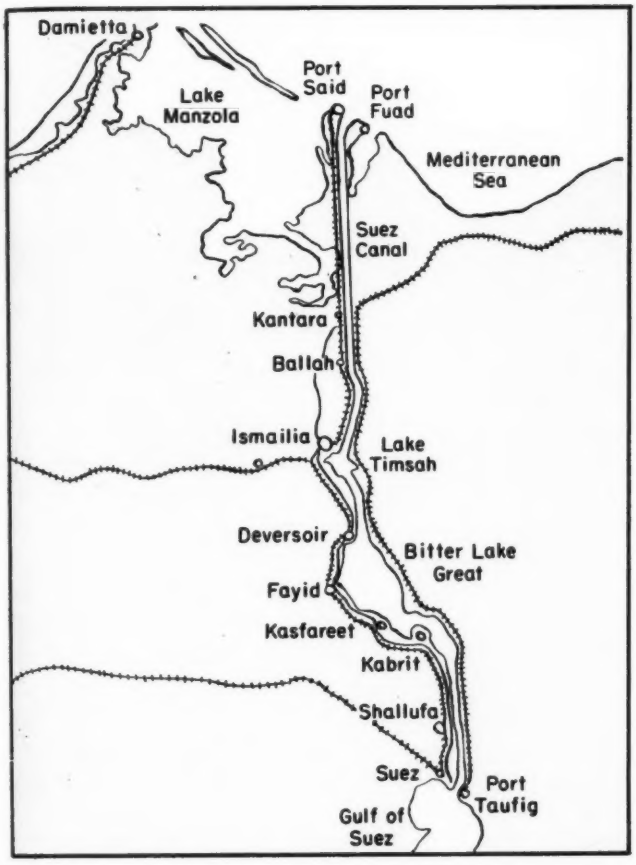
De Lesseps knew something of the history of the Isthmus, and this helped convince him that a canal could be built. In fact, many canals had been built across that narrow stretch of land between the Mediterranean and the Red Sea. There is evidence that one had been constructed by the Pharaohs of Egypt over 4000-years ago. Again, in 1400 B.C. Sethos I and Ramses II constructed a canal between the Nile and the Red Sea through Lake Timsah. The first Suez Canal on the present route was completed about 1000 B.C., and it was reconstructed over a different course at about 600 B.C. Then, the Romans, under Trajan, constructed a canal, and the Ottomans followed this with another canal in the seventh century.

Each of these canals served its purpose for a limited time, but the Nile is a silt bearing river and there is a very small gradient, so it drops its silt in this region and rapidly fills up any man-made ditch.

However, by 1800 European engineering had advanced sufficiently to have been able to dig and maintain a canal through the Isthmus had the facts



SHIPS WAIT THEIR TURN AT PORT SAID. THE SUEZ NORMALLY HANDLES THREE TIMES THE TONNAGE OF PANAMA.



THE SUEZ IS A SEA-LEVEL CANAL WITHOUT LOCKS. IT WAS OPENED 87 YEARS AGO IN NOVEMBER 1869.

been known. Only a colossal error in a report to Napoleon made the project seem difficult. This report stated that the level of the Red Sea was about 33-ft above that of the Mediterranean. This much difference in the levels of the two bodies of water would have required an extensive and expensive series of locks. It was not until 1841, nine years after de Lesseps had become convinced of the practicality of his idea, that a survey made by English officers corrected this error. Finally, in 1856, accurate studies were made by an Austrian engineer, Negrelli, proving that there were only the few feet difference in the sea levels, and locks would not be required.

De Lesseps, ever since his quarantine in Egypt in 1832, had worked toward the development of a company to undertake the canal project. But not until 1858 was he able to organize the Compagnie Universelle du Canal Maritime de Suez. Construction work was begun in 1859, and the canal was completed 10-years later.

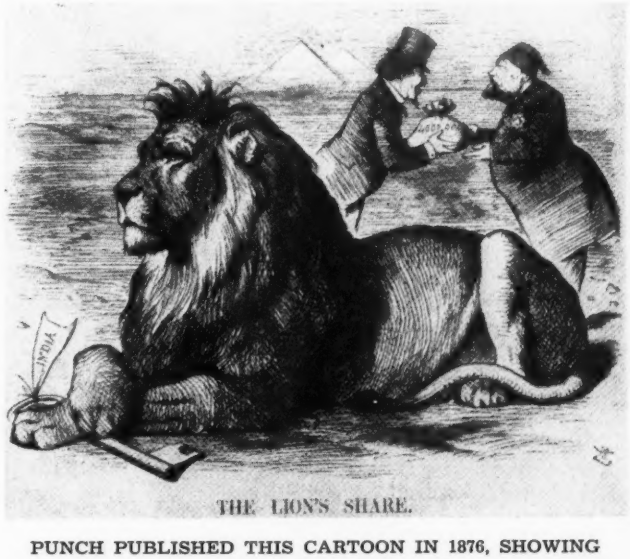
Financing

The financing arranged to meet the original estimated cost was through an issue of 400,000 shares of stock each with a par value of 500 francs gold — a total of 200,000,000 francs. De Lesseps offered the stock to the French bourse in 1858, and it was largely purchased by Frenchmen during the first month. The French government acquired no shares. No Britishers were interested, Russia showed no signs that it considered the undertaking of any importance, and the United States thought of it as being too far away to bother with. Therefore, the canal was almost entirely a French undertaking except that de Lesseps' friend, Viceroy Said Pasha, was naturally involved. He not only granted the company the necessary rights for construction but also subscribed to a block of 86,506 shares. The Ottoman Empire, which then controlled Egypt and took in much of Eastern Europe, subscribed to another block of 96,000 shares. De Lesseps, however, had control of the company.

The original estimated cost of 200,000,000 gold francs soon proved insufficient. Another 233,000,000 francs were needed, and de Lesseps' persistence finally succeeded in raising the necessary money. The major part of this came from Egypt, partly in advance settlement of claims arbitrated by Napoleon III in 1864 in favor of the company, partly by purchase of the El Wadi estate, and partly by Egypt's relinquishment of earnings during the first 25 years on the shares she owned. De Lesseps also arranged for a public loan coupled with a lottery.

The original agreement with Egypt called for her to provide forced labor for the work on the canal. While the workmen's wages were higher than most of them had earned previously, and while they were better housed and fed than most Egyptian laborers, the mid-19th century was a period of social reforms and the idea of forced labor was repulsive to many — including the laborers themselves. On the demand of Egypt, forced labor was terminated, and this turned out to be the salvation of the project. Power dredges and other new labor-saving equipment was put to work so that the construction efforts moved much more rapidly than with hand labor.

De Lesseps encountered more political than engi-



PUNCH PUBLISHED THIS CARTOON IN 1876, SHOWING DISRAELI BUYING SUEZ SHARES FROM THE KHEDIVE.

neering difficulties. In the years immediately ahead of the undertaking, Lord Henry John Temple Palmerston was prime minister of England. He strongly opposed the digging of the canal, particularly if it was to be a predominantly French undertaking. The official position of the British was: the canal could not be built; if it were built, it would be detrimental to British shipping interests; and the entire effort was nothing more than a move on the part of the French to develop Asian interests at Britain's expense. Britain had considerable influence with the Ottoman Empire, and when it was learned that the Porte, at Constantinople, had to approve this contract of de Lesseps', Palmerston intervened and succeeded in having the government at Constantinople hold off the work for two years.

De Lesseps' persistence eventually cleared the way, and the first shovel full of sand was turned by his hand on April 25, 1859. Ten years, six months, and twenty-two days later the canal was ready for use. As constructed by de Lesseps, the canal had a length of 99 miles, beginning from the Mediterranean at Port Said and ending in the Red Sea at Suez. It had a bed breath of 72 feet, a depth of 26 feet, and a water surface width of 190 feet. This was a narrow canal, and there could be no passing except at the lakes or at widened areas known as "gares." Up the canal from Suez, ships had to wait until out-bound or south-bound traffic had cleared. The canal has been constantly widened and deepened since to meet the demand of ever increasing ship size.

It was 87-years ago, on November 16, 1869, that the first navigation of the canal was undertaken by the royal French ship *Aigle*, with the Empress Eugenie and a gala court party aboard. A fleet of 68 commercial ships, all of them sailing vessels, started through the canal the next day. Plying through the newly built canal under indifferent sail, the ships moved forward sluggishly. From Port Said to Suez took three days, the ships anchoring each dusk and resuming their course with the next sun. The effort was a success.

Disraeli's Deal

In 1875 the canal was in its fifth successful year of operation and had been making a profit for three of those years. Benjamin Disraeli, an avid empire builder, was now prime minister of England. One evening a journalist just returned from Cairo told Disraeli that the Khedive of Egypt, now heavily in debt, had his interest in the canal company for sale. By this time his block amounted to 176,602 shares. As soon as a discreet inquiry to the British consul at Cairo confirmed this information, Disraeli acted without waiting to consult either Cabinet or Parliament. He closed the deal with the Khedive, securing the cash from the Rothschilds of London. Disraeli paid the Khedive 3,976,582 pounds sterling, approximately $2,750,000 above par value.

When the purchase of the canal stock was revealed, the press, the public, the Parliament, and the Queen, all enthusiastically approved Disraeli's deal. It was not long before all England was calling Suez the "lifeline of empire."

As the result of Disraeli's brilliant coup, England became a 7/16 owner of the canal and the only goverment owning Suez Canal shares. She profited in many ways. The actual cash profits from the shares had returned her full investment nearly nine times by 1928. In the single year of 1927, dividends on the English shares amounted to better than 1,500,000 pounds sterling. While the French government owned no shares, she also profited from the ownership of the French people. She taxed French shareholders in the canal, and in 1926 this tax amounted to 77,000,000 francs, when five francs were about the equivalent of a dollar.

Both England and France have profited even more through the use of the canal by shipping. For instance the distance from Liverpool to Singapore around the Cape of Good Hope is about 11,000 miles. By going through the Canal, this distance becomes 8000 miles, a saving of 3000 miles that cuts costs and increases greatly the shipping capacity for a merchant fleet.

Improvement and Maintenance

From a strictly engineering point of view, the digging of the canal was not too difficult and improvement and maintenance also has been relatively simple. The tidal variation at Port Said is about 1.44 feet, reaching 3.12 feet at storm tide. On the Red Sea, at Suez, the usual tide is between 2.6 and 4.9 feet, storm tides reaching as much as 10.63 feet. This difference in tides causes a weak current of about 1.9 ft per sec to flow in the stretch from Port Said to Bitter Lake near Suez. Silting due to this slight current is negligible and sanding up as the result of storms is of little importance.

The advent of the steam ship added new impetus to the already extensive improvement program undertaken on the original canal. Every few years the canal was made wider and deeper. By 1887, ships with electric arc lights were permitted to move at night. This cut the time of passage in half. The allowable maximum speed for steam ships was 10 knots an hour until about six-years ago, when the maximum speed was lifted to 12 knots. The canal now is wide enough for passing at any point, even though one ship is still tied up while another goes by. Deepening of the canal to 33 feet was completed in 1924, and this was later increased to 36 feet. It also has been widened to 148-ft bed breadth from the east side of the canal. There are plans pending execution to increase the breadth to 213 feet on a straight course and to 262 feet on curves.

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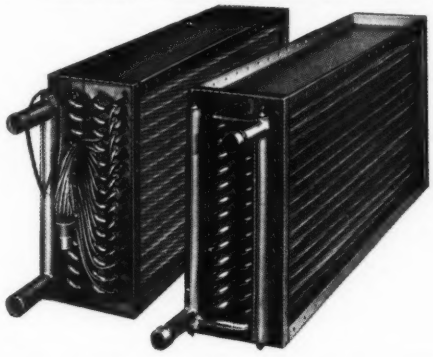

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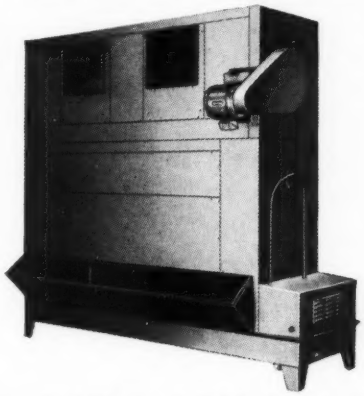

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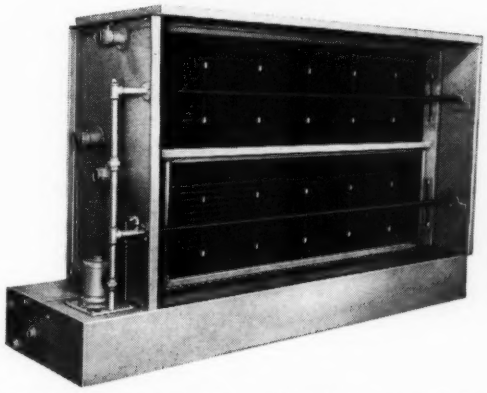

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raising a 2000-ton ship. There is also a fleet of tugboats and a number of floating cranes. A large modern dredge, the *Louis Perrier,* delivered in 1955, can dig 12,000 cubic meters a day with its cutterhead and force debris through a mile and a half of pipe to the shore. The central maintenance plant is located at Port Fuad and is one of the largest in the Middle East. Unfortunately, most of its equipment was sunk or sabotaged in the recent fighting.

Toll Rates

From time to time, toll rates have been changed, always in favor of shipping. In 1885, the toll was fixed at 9½ francs, or about $1.90 per net ton, and this basic toll was lowered by a sliding scale until the annual stock dividends reached 25 percent, when the toll would be 5 francs — about a dollar. In 1935, a maximum toll of 63 Egyptian piastres per ton (about $1.86) was set, but this maximum has never been charged. All tolls for passengers were eliminated in 1950, and the actual tolls, fixed in September 1951 and still current, are 17 piastres per net ton for ships in ballast, and 36.5 piastres (about $1.05) per ton for ships with cargo. Ships below 300 tons, without passengers, pay no toll under the 1951 schedule.

There has been a constant increase in tonnage throughout the years. For instance, in 1926, 26,100,000 tons passed through the canal. By 1950, this had increased to 81,795,523 net tons. The magnitude of this shipping can be appreciated by comparing it with the 30,000,000 tons of shipping that passed through the Panama Canal in 1950 — incidentally, at a charge of 90¢ per net ton.

It is obvious that the Suez Canal has been a successful economic venture. The original shares were split 2 for 1 in 1924 and currently have a par value of 250 gold francs. The French families who put their faith in de Lesseps now hold tightly to their shares. In 1928, a share with a par value of 250 gold francs was worth 18,000 gold francs, 72 times par. In 1955, the Canal's net profit amounted to $30 million.

The current troubles are one of the first major political crises of the canal. Considering its strategic importance in both peace and war, it is surprising that there have not been more. On October 29, 1888, the canal was neutralized by an accord between Turkey, Britain, Germany, Austria-Hungary, Spain, France, Italy, The Netherlands, and Russia. Under this treaty the canal would always remain free and open in time of war as in time of peace "to every vessel of commerce or war, without distinction of flag." England, however attached a proviso to her signature to the effect that the accord would not limit her freedom of action during her occupation of Egypt, a proviso not withdrawn until 1904. In 1898, Spanish ships of war were denied use of the canal when they were enroute to the Philippines to battle Dewey's fleet at Manila. But in 1904, Russian ships of war passed through the canal on their way to battle Japan in Asian waters. In 1914, the canal and its administration was turned over to the British military, and during the entire period of World War I, the area was heavily armed. No German or Turkish ships went through. Mussolini's ships, war vessels and commercial, during his aggression against Ethiopia, continued to pass through the canal.

However, on June 9, 1950, Egypt prohibited ships bound for Israel and all Israeli shipping from the use of the canal. Egypt maintained that the legal reason for this action was absence of a formal peace treaty with Israel. Despite United Nations resolutions and a formal appeal to Egypt to raise the blockade against those ships, Egypt refused to let them pass.

It can be seen from this resume that neutralization of the canal has frequently yielded to exigent circumstances, but always the canal has been reopened whenever conditions improved. The current refusal to permit passage of Israeli ships or Israeli shipping is the most flagrant example of partial closure of the canal during peacetime.

De Lesseps' Later Ventures

De Lesseps' activities after his successful canal venture constitute a rather unhappy footnote to the story of Suez. Having succeeded in Egypt, de Lesseps, whose fortune seemed assured and whose name was a household word throughout France, turned his interest toward Panama. Because of the success of Suez, he had little trouble in arousing interest in his new venture. In 1883, digging began. But his plan, the tropical climate, and disease all were against him. He gave up in 1888, the Company bankrupt, his fame sullied with recriminations, his fortune gone. The French "Affair" ended one year later, and the United States purchased the French interests in the new canal for $40 million. De Lesseps was a broken man. His son Charles took upon himself, so far as he could, the opprobrium of his father's failure, and the family shielded the old man from the violence that assailed his reputation and attacked his honor. He died in 1894 at the age of 89.

Despite de Lesseps' financial failure and his disgrace in France in connection with the Panama Canal venture, he had received his share of honors. The French Academy had elected him a member as did the Academy of Sciences, the highest honor the French gan give a man of science. He also was decorated with the Grand Cross of the Legion of Honor.

Even after his failure at Panama, he remained a British hero. He was made a "Citizen of London" and decorated with the Star of India. He received the freedom of the City of London from the Lord Mayor, and the English public continued to respect his name. Only in his native France did the financial scandal of the Panama Canal Affair lower de Lesseps in the public esteem. He is, today, one of the few 19th-century engineers whose name is remembered throughout the world. ▲▲

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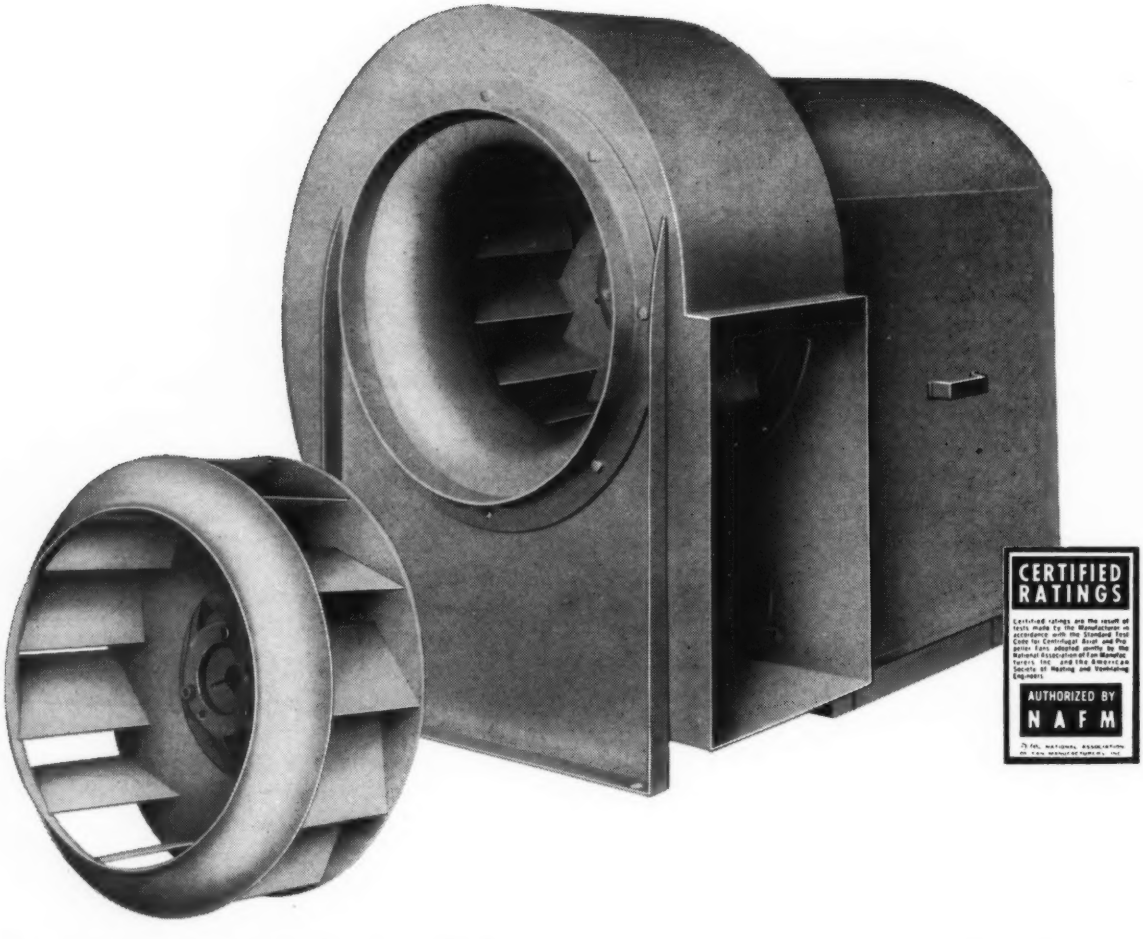

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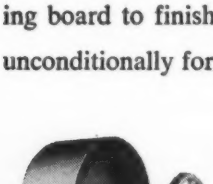

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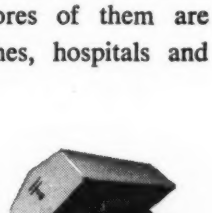

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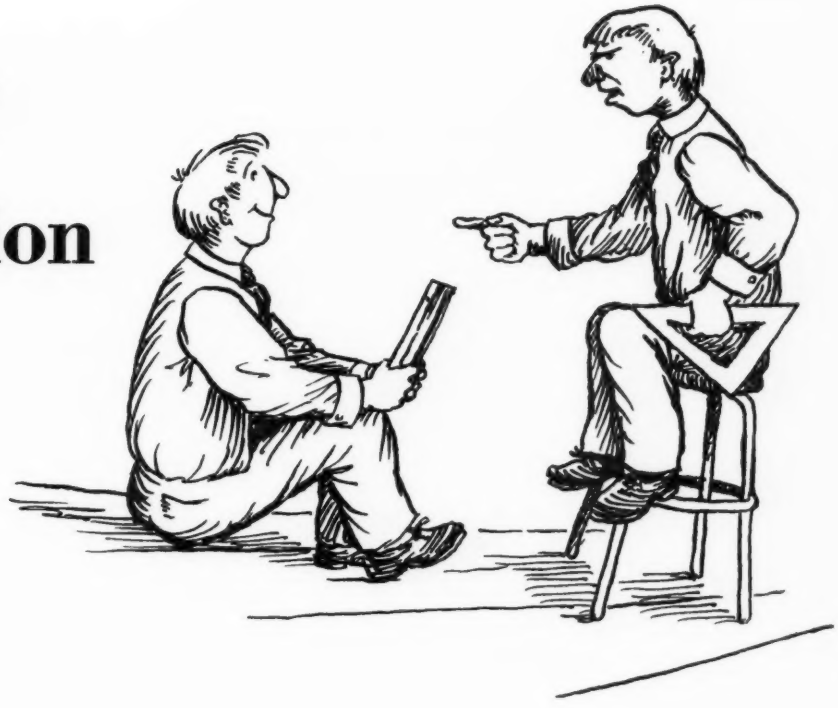
Part IV

STAFF REPORT



THERE IS A GREAT DIFFERENCE between fact and opinion, but opinion can be more valuable than fact. We can present facts only in connection with what has happened in the past or what is happening now, but opinion can look into the future, can point to what should be done. Part I of this "Survey of the Profession," published in January, and Parts II and III, published in February, dealt only with fact. They gave a picture of the average consulting engineering firm as it was first organized and as it is today. Part IV of the survey deals with opinion and advice. As such it cannot be collected so easily into tables and charts. Much of its value lies in the statements made by those answering the questionnaires. The most interesting and important of these are quoted later in this report.

Part IV of the survey questionnaire was prefaced with this statement: "Assume that a good engineer who is now working for industry or government came to ask your advice. He wants to go into private practice." Then, the first question was, "Should he associate with one or two other engineers or go it alone"? The answers indicated that more than three-quarters (78 percent of the engineers in the country) would advise this man to associate with someone else, if possible with an established firm. In matters of opinion, however, the minority, in this instance, could be just as correct. There are 22 percent of the established consulting engineers in the U.S. who think the best opportunity in private practice is for the man who opens his office as a sole ownership and operates independently.

All sections of the country are in relative agreement on this, but it is a little surprising to find that the Southwest is the strongest proponent of joint endeavors. One would think that the Texan would be the typical individualist, the one who would prefer to go it alone. He is not. The Texan and others from the Great Southwest are more in favor of partners than any other part of the country. Only 18 percent preferred to operate alone.

Type of Service

When a man starts into private practice, should he try to offer a broad range of engineering services, or should he confine himself to one specialized field? This is a difficult question to answer, for no two men will have exactly the same ideas as to what is broad and what is specialized. It can be assumed, however, that in civil engineering confining ones self to municipal water works design would be typical of specialized work, while general civil engineering, ranging from reservoirs to structural would be considered broad. Draw your own dividing line.

In any event, 60 percent of the engineers in private practice in the U.S. recommended that the newcomer confine himself to specialized work at the start and establish himself as an expert in that field before expanding his firm to other activities. Broader fields were recommended by 40 percent. If this young man were to call on 10 engineers for advice, he would hardly know what to do, for 4 would tell him one thing and 6 would recommend the opposite. No doubt the truth is that his own personality and experience would be his best guide.

These recommendations are of more value if examined by sections of the country. Note that in the East and Midwest higher percentages of the answers show a preference for specialized work.

ALONE OR WITH A PARTNER

Section of Country	Would Associate %	Would Be Alone %
South	72	28
Midwest	75	25
Southwest	82	18
East	77	23
West	75	25
Total U. S.	78	22

TYPE OF SERVICES OFFERED

Section of Country	Specialized %	Broad %
South	55	45
Midwest	65	35
Southwest	42	58
East	68	32
West	57	43
Total U. S.	60	40

IS NOW THE TIME TO START?

Section of Country	A Good Time %	A Bad Time %
South	80	20
Midwest	84	16
Southwest	79	21
East	83	17
West	90	10
Total U. S.	84	16

In the other sections of the country there are more who lean to broad services. The Southwest even shows a good majority, 58 percent, preferring general practice to specialized work. This is understandable, for there is probably a better opportunity for the specialist in the urban and highly industrial areas, while the less industrial areas need engineers who will take just about any type of project. Therefore, if a young man were to follow this advice, he would specialize in the big cities and become a general practitioner in other parts of the country.

The other question in this Part IV that could be tabulated asked, "Does this seem like a good time to go into private practice?"

The answer would seem to be an only slightly qualified "yes." In the U.S. as a whole, 84 percent of the engineers say the time is right. This holds true for all sections of the country, with the West being a little more positive (90 percent) than the rest of the country.

How long would it take this man to establish himself and get his organization out of the red? Answers ranged from one day to ten years, but there was rather good agreement that two years is about right. By that time he should be doing well.

Summary of Opinion

To sum up these opinions, a good engineer now working for industry would have the best chance of succeeding in private practice if he were to associate himself with another engineer, settle in the West, and offer broad services if he opened his office outside an industrial area and specialized services in a highly industrial community. He should also recognize that dogmatic statements such as that, based on the averaging of opinions should be taken with much more than one grain of salt.

Personal Advice

The questionnaire left a lot of blank space for personal advice to this young man starting in private practice. A study of these comments gives a good idea of how the consulting engineer feels about his own work and those who would enter it.

The advice has been sorted into ten general categories, each dealing with one aspect of going into private practice or succeeding in that field.

Capital and Financing

Foremost in the minds of most of the engineers giving this advice was the question of capital and financing. Here are actual quotations:

Don't try to start on a shoestring. Get someone behind you with sufficient capital before you start in business for yourself.

Never try to go into private practice without excellent financial backing.

Watch the overhead. Don't get too big too fast. Grow with the business.

Have sufficient funds to carry through the first two years and have a reliable source of professional and drafting help that can be utilized on short notice.

Have at least $10,000 available to start with and assume that it will be used up along with any income from consulting work during the first three years.

Think it over very carefully and try to evaluate the true extent of your dedication. This is not a "Get rich quick" business. Corporate income tax laws and the personal income taxes make it extremely difficult to grow.

Do not expect to make a killing the first five years. A slow and steady growth has, in the past, produced our best firms of today.

Be sure to have enough capital to support your-

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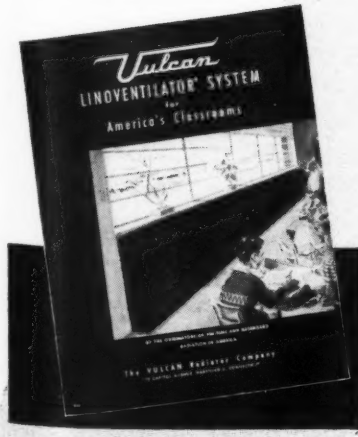

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self for at least a year without any money coming in.

Arrange your personal financial affairs to cover the first few years of work.

Have enough money to purchase the necessary equipment and to live comfortably until the work comes in.

Have a minimum of $10,000 to start out or establish good credit. Check with your banker and Dun & Bradstreet.

Get good banking connections and follow sound financial advice.

If you can afford to go into debt at least $10,000, the amount you will need to cover equipment, office, salaries, and lack of connections, go to it, boy.

Be prepared to have a tough time for possibly five years, but have the courage to stick it out as it will pay off in the long run.

When you start off, it is a good idea to offer other engineers your services to help take the load off their shoulders. This will fill the gap for you.

Keep your nerve and cut your overhead.

Start slowly to establish yourself. Do the best work possible even if you underestimate your cost. Make good regardless of profit or loss. After 52 years of practice I feel qualified to advise.

First, hold your overhead down. Count on doing several jobs yourself—bookkeeper, stenographer, and some drafting.

The mortality rate is very high. This is usually because of insufficient financing. You might expect to lose $50,000 before establishing yourself.

Do not try to save money by hiring cheap "help."

Don't overcapitalize.

It is much tougher to start now than it was 50 or even 25 years ago. But it can be done if you have something to offer. Be prepared for a few lean years.

Put down those rose-colored glasses.

Get out of the big towns. Prepare yourself and your wife for long working hours, restricted budget, and worry. Have good legal advice. It takes $20,000 to make it for one year.

Work, Work, Work

Consulting engineers do not seem to think that their jobs are easy. Over and over again they emphasized the need for more than a 40-hour week.

Be ready to work hard and long hours. Do only what you can and do it when the client wants it—not a week later.

You will find that you are working twice as many hours for yourself as you would be for anybody else.

Work 18 hours a day and keep a close eye on the bookkeeper.

Be prepared to work 60 hours a week and have many bosses.

Do it with the fullest confidence, not with reservations. Assume you have all to gain, little to lose—forget standard hourly work day and week and think only of getting the job done.

If you want to work 44 hours a week, forget about going into business for yourself.

Work 75 hours a week and you can't help being a success.

The 40-hour week is the way to fail.

Be prepared to work, starve, and worry without getting discouraged.

You will have to be the toughest boss you ever had.

Hard work is most essential. Active participation in engineering, civic, and other organizations is important.

Hard work and long hours will do much to take the place of capital.

Be ready to work harder than you thought was possible for a human.

Try it and start worrying or relax and stay with industry or government.

Beginning a business is tough. Do not get discouraged because you make a slow start—everyone starts slowly.

Purchase a large supply of aspirin and prepare to work harder than you ever did before.

Point of view, ambitions, and ability to control your family are the vital points. Once you start, never stop. Times will seem hard and sometimes impossible, but keep going and try never to be discouraged. Charge reasonable fees, work hard to elevate the profession, keep overhead low, and do the best work you can.

Work hard and ask other consultants for advice. Don't be afraid to get a retainer when possible.

Private practice offers more income and a great challenge, but it is not for the man who wants a guaranteed wage and an 8-hour day.

What Else it Takes

Being a good engineer is obviously not enough, that is, if these advisors are right. It seems that salesmanship and personality are equally as important—if not more important—than pure technical ability. Here are more opinions:

Have plenty of money to back payrolls and general expenses until fees come in. Get good lawyers and accountants to keep you out of trouble. Be prepared to give up engineering design in favor of administration, contact work, and footwork.

You must have administrative ability.

You must first be an engineer—yet of equal importance to your success, you must be a business man and a salesman.

Learn something about administrative and tax problems.

Before starting in business, brush up on sales psychology, bookkeeping, and the social graces.

Any engineer planning to enter business for himself should realize the importance of having at

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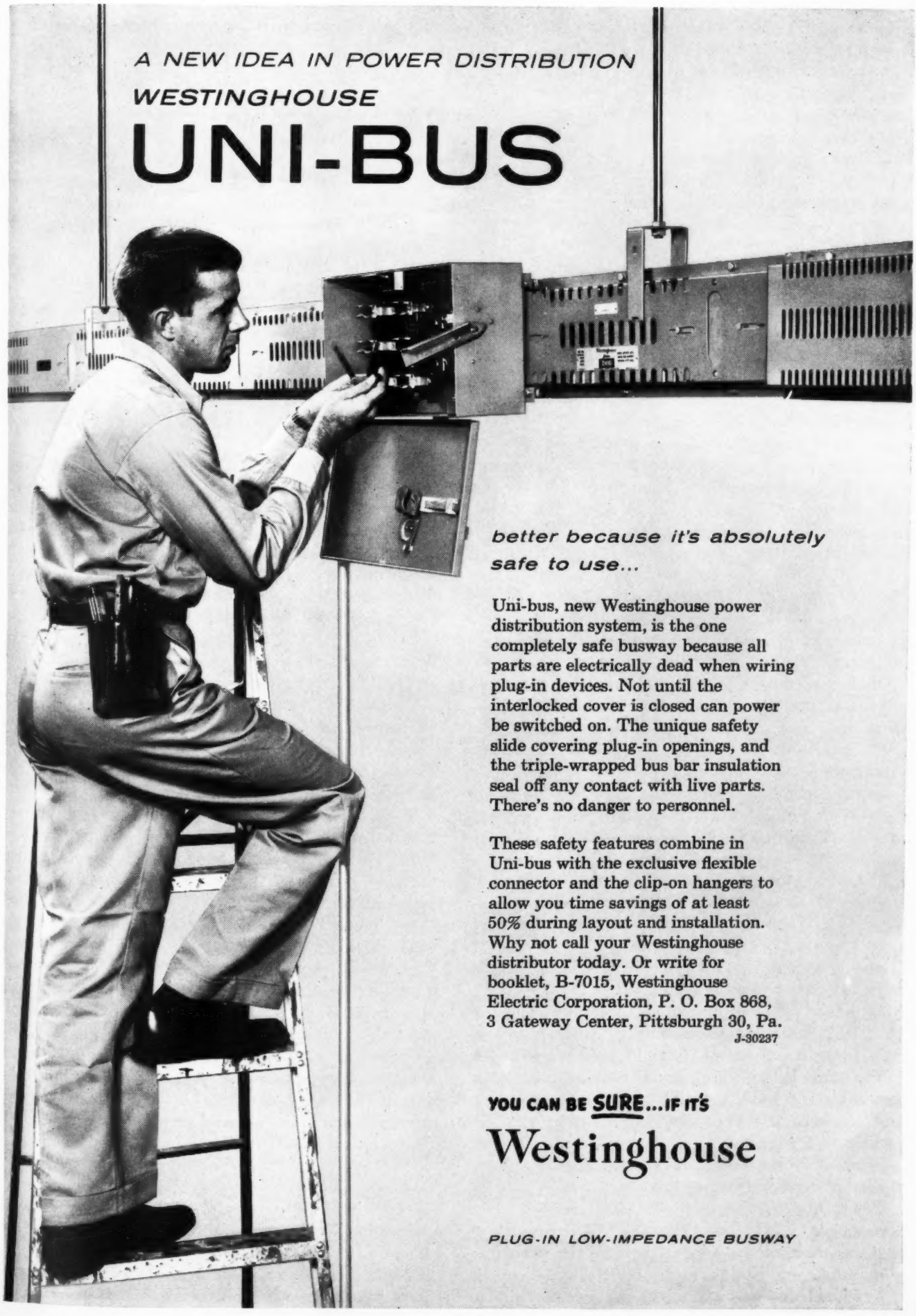

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least a basic knowledge of good business principles and practice.

Study commercial law before you open your office, especially the laws of contracts, and then hire both legal and tax advice and follow it.

The trap that most engineers fall into is complete inability to become businessmen.

It takes more than just engineering ability to make a successful private practitioner.

Learn how to run a business before trying to start one.

Develop a broad knowledge of not only engineering but business, political science, and financing of engineering work.

Even small offices must have good business management. The cost of doing business is not cheap, and responsibilities are many—be aware of this. Have enough financing so that you will not have to worry constantly about collections.

One must have physical and mental endurance, "sticktoitiveness," a thick skin, a pleasing personality, and/or considerable technical ability.

If you are working in a rural area, you have to do everything that might be thought of as technical. We never turn down any job that is brought to us. We are expected to adjust instruments, sharpen drafting tools, repair tapes, spot water wells, lay out house foundations, and anything else the folks around here want. Actually, we are mining engineers. This is just to let the young man know what he may expect in a rural area.

With a lot of guts, a good wife, and no worry about the Jones' next door, you might make it.

The prospective consulting engineer should make sure that his personality is just right for independent consulting work. The best engineer is doomed to failure if his personality does not fit the job. Before starting he needs a psychologist just as much as an attorney and a CPA.

Make sure that you are a person who would be happier as an individual than with a corporation. You must be a salesman. Very few engineers are able to guide their own activities.

Be a good salesman and be competent to ethically back up the engineering you sell.

A person going into private practice needs to have had successful experience in dealing with the public—preferably some kind of sales experience.

You must be willing to spend time on promotion and sales and have the ability to speak in public and to write clear concise reports that can be readily understood.

If you have no business and management ability, work for somebody else that does.

Get to know all of your competition.

Associate as soon as possible with a consulting engineer association to learn some of the problems and pitfalls of private practice.

A knowledge of your field is not enough. A successful engineer must be an extrovert capable of speaking and writing with authority.

Understand that the longer you are in business, the less engineering work you will do. You have to be a businessman and salesman, too.

Study business law, salesmanship, and public speaking.

Learn management controls and business administration—then think like top management.

Affiliate early in your career with one of the most outstanding personalities in your field. Become his "right arm" and learn his techniques for acquiring and serving clients.

Develop your personality. Don't hesitate to be dogmatic when you are right. Become a "controversial" figure.

Write papers and articles; establish a reputation.

Have faith in your ability. Join professional societies. Become active in civic works. "Extrovert" yourself.

Expect a tremendous amount of time to be consumed in contacts, correspondence, bookkeeping, and free advice. After the jobs begin there is not enough time to do them. Expect all jobs to take longer than they should. Expect to have very little time for your family. Expect long hours—80-hour weeks are not unusual. Maintain association with professional societies. Establish absolute confidence of every client through understanding of his problem and through competent service. Maintain top ethics or drop the job.

Pound the pavements. Get active in social organizations of businessmen.

Be ready to meet the unfair competition from Federal and State government institutions and from universities.

The prospective consulting engineer should have attained some accomplishments in the engineering field. He should have reached the age of 40 or more. A widespread acquaintance is important and he should become an expert in the field of law, taxes, personnel, sales, collection, and financing as well as engineering.

A broad practical experience is one of the most essential factors in the building of a professional career. A young engineer fresh from school cannot possibly visualize the field problems.

Be aware of the fact that in addition to being a good engineer, you must be a promoter, bill collector, tax expert, personnel manager, businessman, administrator, and financial expert.

Look Before You Leap

Private practice is not something that an engineer should jump into without giving it careful consideration. Here are some warnings from those who already have been initiated.

Make sure that you know what you are getting into. See that your family understands your prob-

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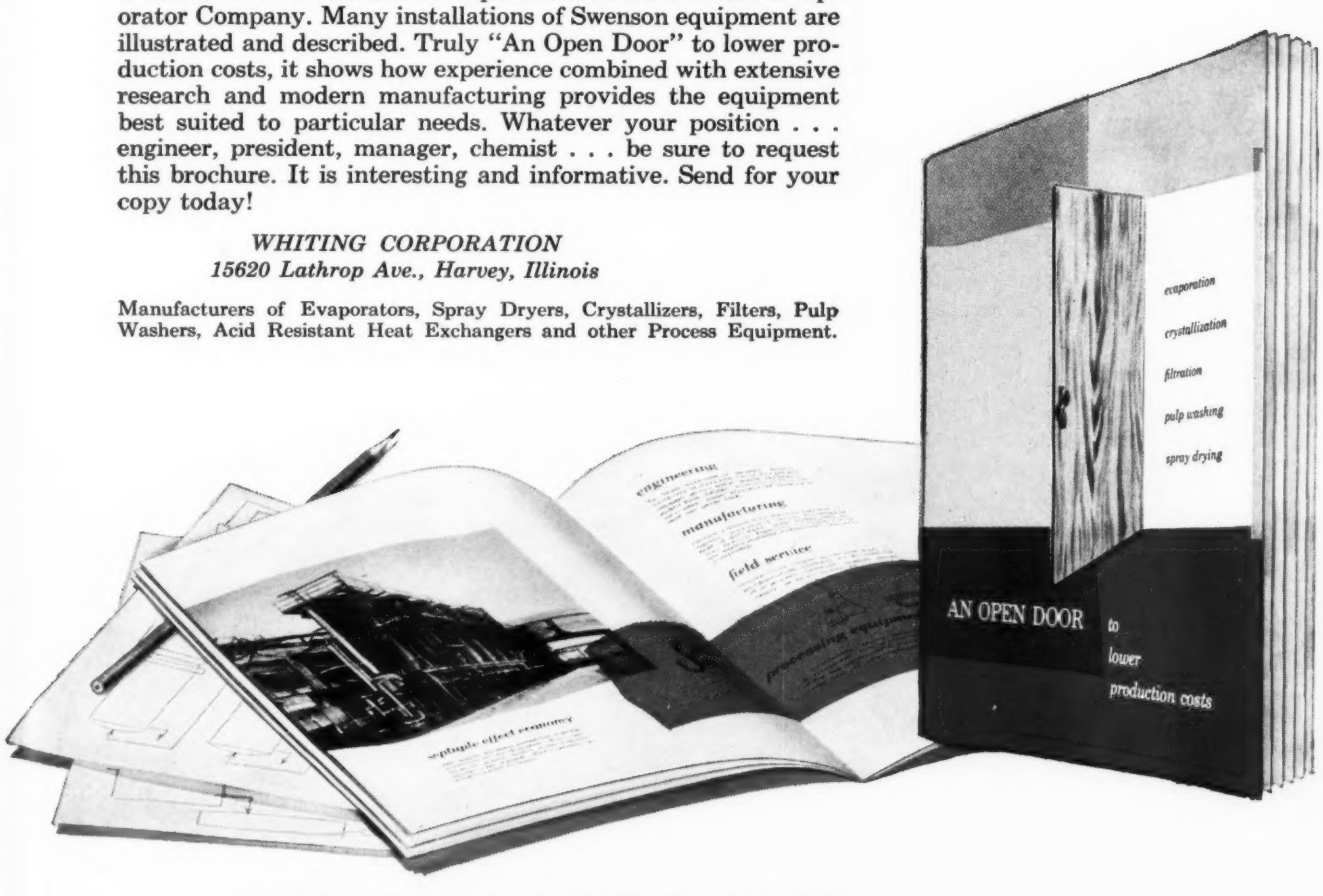

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lems. Have about five years experience in a consulting office. Go into private practice only if you are sure you have enough contacts to carry you for the first several years.

Check carefully into profit making potential of your service.

Line up prospective clients first.

Make a complete survey of potential business possibilities.

Go find a client before you go into business.

Line up some bread and butter work first.

Have some projects lined up before taking the plunge.

Look over the locations. Make careful surveys of towns for the best opportunities.

Location means a great deal. There should be at least 100,000 in the county in which you locate and good growth for the 50-mile radius around you.

Don't. Keep on working for somebody else.

Do it now.

Keep the job you now have.

Get into the water—if you can swim, okay. If not —get out.

It's like getting married. No one will listen to your advice and there are always times when you are sorry.

Know your business, your clients, and your bank account before you start.

The best possible advice to a young man considering private practice is "Don't."

It is best to have six brothers who are competent engineers and who don't have families.

First marry someone who has plenty of money.

No recent engineering graduate should attempt private practice. He should associate himself with an experienced engineer for a minimum of 10 to 15 years.

You are crazy for trying it, but you are crazier if you don't. If the man going into private practice—or his wife and family—cannot stand uncertainty and risk, he'd better stay out. Confidence is of primary importance.

Make a complete survey of the area in which you intend to operate before going into business.

Take a chance—what have you got to lose.

Get the full approval of your family—you will need it.

Join a consulting engineering group. Charge proper fees. Find out the problems of existing engineering offices and make contacts.

Partners and Employees

Some engineers think you should go it alone, others, that you should associate. But in almost every instance, they warn you to be very careful of the men you decide to associate with in this profession.

Associate with the highest type engineers and technicians, then the projects you undertake will naturally be completed to the satisfaction of all involved.

Team up with an engineer who has broken ground. One who has made some progress as an independent.

Associate with another engineer in a specialized field where the particular needs of such services are apparent.

Find a good partner.

Don't form a partnership.

Work alone. Do not hinder yourself with established ties and conditions.

Be careful of the men you hire.

Try to hold the firm size down so that all partners can produce.

He travels the fastest

Who travels alone.

Keep the organization to a size that fits the capabilities of the experience in seasoned members of the staff.

Be careful in your selection of associates.

Watch out for partnerships. They may be hard to dissolve if they do not work out. When you work for a large firm or as its subsidiary, you are building up their reputation, not your own. Eventually, you must go alone.

Locate where you can get part-time men such as college professors on structures to work when you have more than you can do. Get an inexpensive office and keep your employees at a minimum. Pay your help overtime and good bonuses.

Experience Necessary

It would seem that private practice is not for the young and inexperienced. Much good advice came from the older engineers warning young men to get plenty of experience before starting on their own.

Secure experience in an engineering office before opening your own business so that you can become aware of the many business problems.

Spend at least three years working for a good construction firm.

Learn the fundamentals first—good drafting and accuracy.

Go to the large metropolis and work for another engineering firm first. Get experience from their problems before going into business alone.

By all means get as much experience as possible in a reputable firm before attempting private practice. Many, many men try too soon.

Have about 10 years or more experience of engineering in industry.

Opportunities in rural areas are excellent, but it will take several years of educating the public before they are aware of your engineering services.

Don't get impatient. Get as much varied experience for as long as you can stand working for someone else. Working in the public domain, no matter how competent you may be, is no substitute

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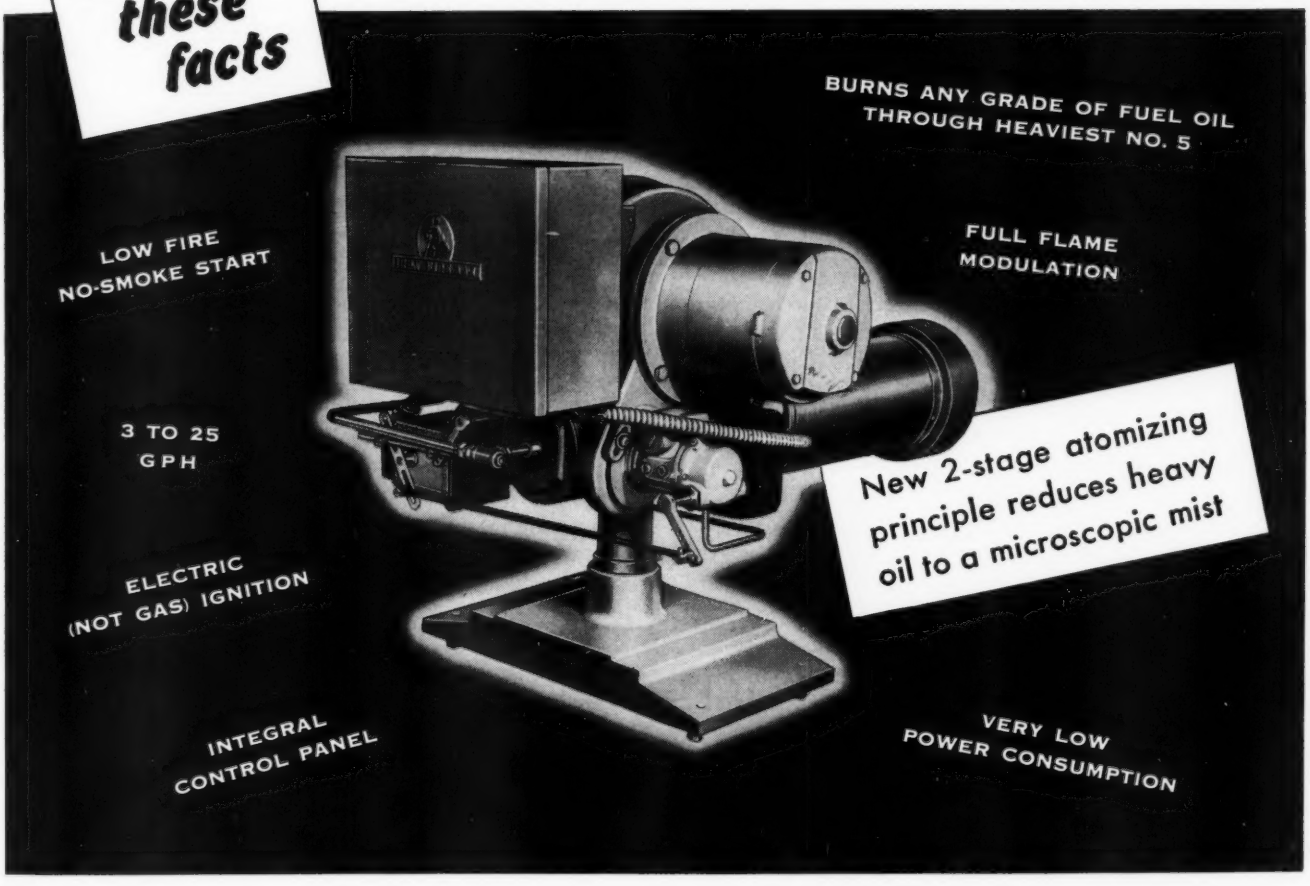
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for having been around a long time — and a sprinkling of grey hair.

Try to associate with a firm operated as a proprietorship and eventually acquire control through retirement of the owner.

Get consulting experience with established firms, don't expect to get rich quickly; do not sell yourself cheaply; and don't yield to expediency.

First have some experience in construction and plant engineering.

It is always best to go in with an experienced firm. You can make your contacts in that way and the firm can help you get started.

Talk to established and successful engineers before attempting private practice.

Become acquainted with latest techniques and practices and keep abreast of all new developments.

Try to get with a large corporation in their engineering department. Work hard, listen a lot, and don't talk too much. After you have had your experience, that is the time to think of going into private practice.

Look for an opportunity to go into a firm where the senior partners or principals are approaching retirement ages. There are many such opportunities. Young engineers should go to work for established consultants, and if they prove themselves, they will eventually be taken into the firm. This way they will be much further ahead financially and prestige-wise.

Associate, all possible, with other engineers.

Fees and Collections

You have to charge the right fee and you have to collect it in order to stay in business. Apparently, some engineers have a tendency to cut fees, and the word from the older man is, "Don't do it." Also, the public has a tendency to put off the engineer's bill in the same way that it puts off the doctor's bill. Collections are important.

Put your fees higher than you think the client will take. The higher your fees, the more business you will get.

Don't be fussy about asking for a substantial retainer to cover all contemplated expenses and at least 80 percent of your fee. It's better to get paid for your work without law suits.

Don't take very small jobs for unimportant clients. Have signed contracts or agreements for all work.

Join the local credit association and watch your accounts receivable.

Be very careful about estimating your engineering cost. Do not be afraid to keep fees well up—this may save your shirt.

Be sure your clients will pay promptly.

Start with small jobs and do not cut your fees. If you do, you will not be able to change later.

Keep your fees high and collect on monthly statements. The greatest stumbling block is financing. Some operating capital will be needed, but get started.

Do not start with too low fees in order to get work. Get advice from practicing engineers and join an organization of consulting engineers.

Never cut fees in order to get started. It will be next to impossible to raise them later.

Maintain an accepted standard fee schedule and never cut fees to get a job.

Keep your expenses to a minimum. Charge legitimate fees. Don't be afraid to ask for your fee when due. Get a signed contract prior to starting a job. Join a consulting engineers' society.

Go after the big jobs only. Don't get bogged down doing the small work where all your time is used with no profit.

Select clients who pay their bills.

Make sure you know how to say "No." Don't be afraid to turn down work that you feel you might not be able to complete on time. Also turn down any job on which the available fee is lower than that agreed upon in your area.

Find out what the established fees are and never underprice your services.

If people like you and respect your work, you can pull out a lot of feathers without the goose squawking. "Consider that day as lost whose low descending sun finds estimates made at cost and business done for fun."

Learn to write contracts. Collect bills promptly.

Contacts and Client Relations

How do you find the clients, and after you find them, how do you deal with them? Here is some good advice on that subject.

A number of successful engineers say that when working for one client, spend 40 percent of your time looking for the next.

Have good banking connections and good club and society contacts. High ethics and absolute honesty are really more important than special technical ability.

Money! Contacts!

Forget about your friends and get work from strangers. Also, you don't have to take every job offered you.

Never rest the success of a business on a single client. Be prepared to work a completely unpredictable schedule.

Learn to meet your client, and speak his language —don't act like you know it all.

Don't try to get rich at the client's expense.

Start in a location where you are known. Be active in civic work. Concentrate on smaller, less profitable jobs where established firms are not competing. Those jobs lead to bigger work when well handled.

Good contacts and reputation for past work are necessary. If you are willing to take small contracts

Ilg LSQ Power Roof Ventilators have the low silhouette you want for modern buildings . . . and a great deal more. Quiet, trouble-free operation is assured by a direct-connected Ilg motor with permanently lubricated ball bearings, exclusively for fan use. All-aluminum housing never needs painting. PFMA label certifies all ratings. For East End School, Burlington, N. C., The Man from Ilg recommended two large LSQ's for the auditorium, a smaller one for the kitchen dishwasher. The Man from Ilg is ready to work for you . . . call on him to help you plan any ventilating installation for peak efficiency and lowest final cost.

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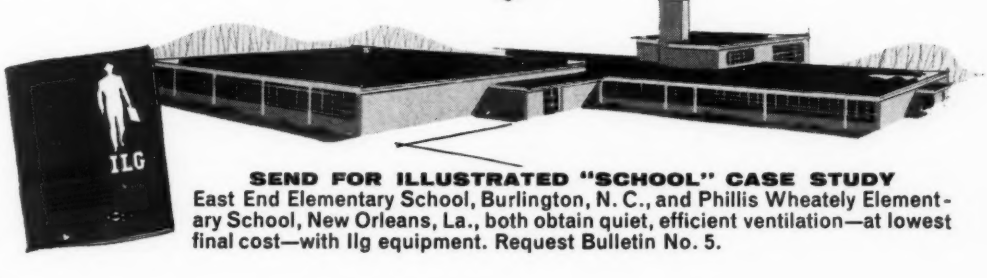

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East End Elementary School, Burlington, N. C., and Phillis Wheately Elementary School, New Orleans, La., both obtain quiet, efficient ventilation—at lowest final cost—with Ilg equipment. Request Bulletin No. 5.

PERHAPS YOU WOULD CONSIDER THIS CONSULTING FIRM WHERE ALL THE PARTNERS ARE OVER SEVENTY.

and overflow from large, well organized firms, you can make it go.

Build up contacts. "Who you know" is sometimes more important than "What you know."

Throw away those business cards and make all contacts personal. Keep up to date on happenings in your field.

Prepare yourself for meeting clients and the public. Your work will be selling yourself, for there are many engineers as well qualified as you. Have a dependable staff that will require nothing more than your own supervision.

Don't be afraid to knock on doors looking for work. Personal visits to prospective clients mean a lot.

Remember that satisfied clients are the backbone of any practice.

For every client you accept, refuse to accept ten.

An understanding of the thought processes of mayors and city councils and the ability to make them like you and make them believe that you know what you are talking about is of prime importance. You should be enthusiastic about the job, and if you are fee conscious, don't let it be too evident. Get them to work with you by making suggestions and establish a reputation for being easy to work with. Don't try to be a big engineer. Stay away from politics and religion in your conversations. Tell the truth even if it hurts your prospects.

First contact the state consulting engineers association for guidance on problems of practice.

Avoid dealing with architects or clients who try to negotiate on a fee basis.

Selecting the Field of Work

Should the freshman engineer in private practice try to offer broad engineering services or stick to a specialized field? Here is some specific advice on that subject.

Cooperate with other firms for other engineering skills than your own.

Offer a complete engineering service.

Choose the work you like best, not the one that seems to pay the most—you have to live with your work.

Avoid architects.

Stick to the field you know. It is much easier to become an expert than to furnish an all around engineering service.

Do not offer your services in fields in which you are not thoroughly competent. This is the most flagrant violation of ethics today.

Get a sound diversified background and then specialize in the field or fields in which you are most proficient.

On entering private practice seek the heaviest form of work available. Continue to practice personally. Turn out only top quality work.

Do not attempt to undertake projects for which you are not qualified.

Try to get as much private work as possible as against government or working for architects. Familiarize yourself with good business practices and engineering law.

Accept only those jobs in the fields in which you are qualified.

Never overstep your experience or knowledge.

Don't be too conservative about tackling something new. Go into it and explore it completely. As Alexander Hamilton said, "Men give me credit for some genius. All the genius I have lies in this. When I have a subject before me, I study it profoundly, day and night it is before me. I explore it in all its bearings. My mind becomes pervaded with it. Then the effort which I have made is what people are pleased to call the fruits of genius. It is the fruit of labor and thought."

Honesty is the Best Policy

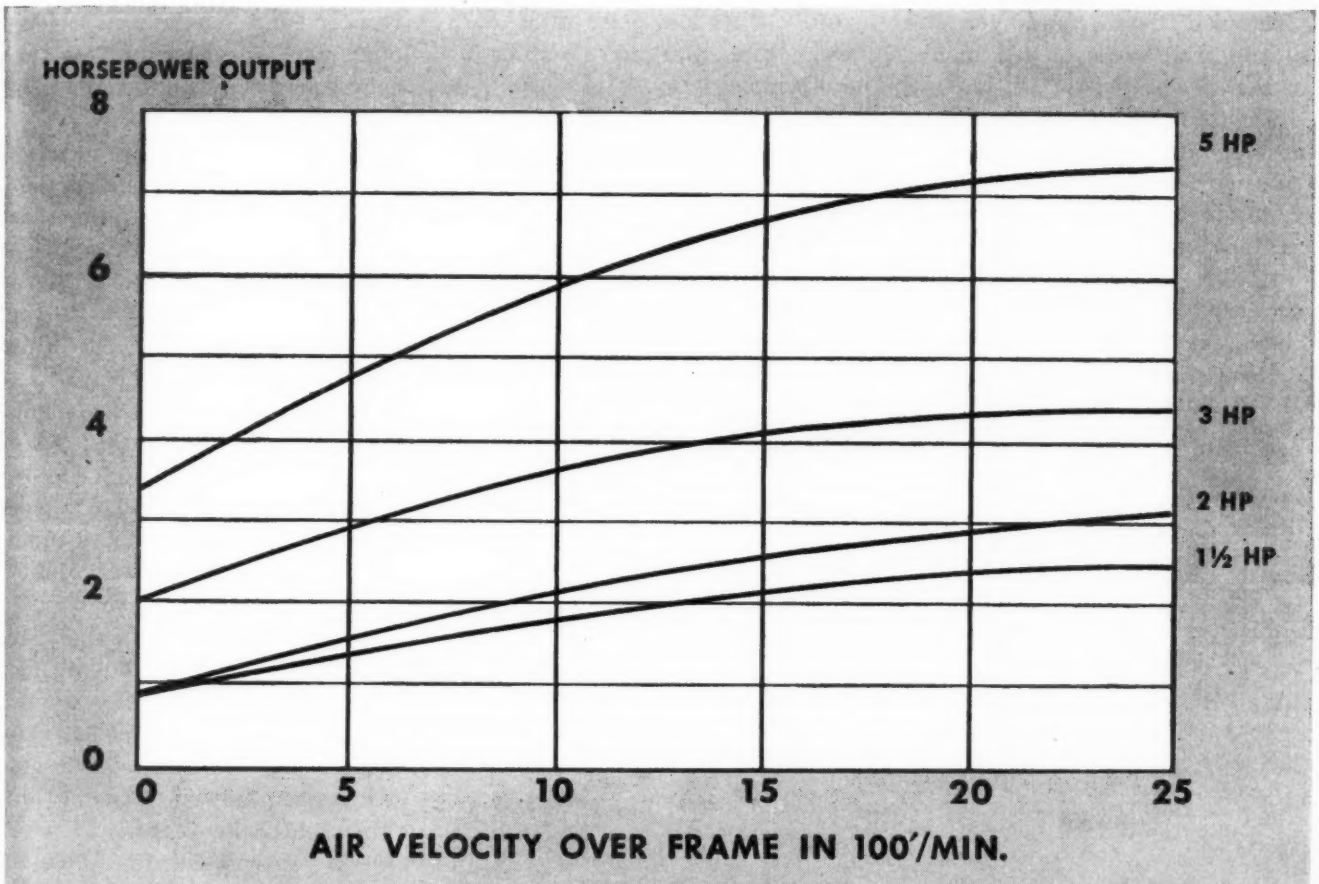
Ethics and honest dealings are the way to success. Many of these specific words of advice could be combined into the Golden Rule, but some times such direct advice as this is helpful.

Keep your eyes set on the highest principles of the profession regardless of monetary factors.

Be wary of too much trust in salesmens' advice. Represent yourself with confidence to the client. Try to follow ethical standards, but don't be surprised that others don't.

Concentrate on turning out good work on time. Don't oversell.

Be absolutely right in even the smallest details. It sometimes takes days or weeks to perfect a



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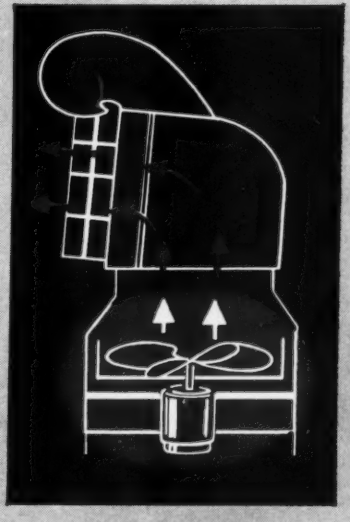

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structural detail, and yet the second trial takes only a matter of minutes.

Render only top quality service at adequate realistic fees.

Insist on contractors meeting your specifications but keep plans and specifications practical.

All you have to sell is knowledge and integrity. Don't shortchange anybody on either one.

Do a good job whether the fee is $10.00 or $100,000.

Maintain personal contact with your clients and don't take more work than you can produce at one time.

Service, integrity, high principles before profit. This will give you the greatest satisfaction in your work, will add prestige to your reputation and to the profession. I believe that in almost every instance this will lead to more profitable operations.

Pursue your profession with diligence, dignity, and complete honesty in order to gain public respect and confidence. Never offer your services for less than established or recommended minimum fees.

Realize that if you are to follow engineering as your chosen field, the financial remunerations are modest and your reward must be your honest desire to be a good engineer and your ability to contribute to the society in which you live.

Avoid criticizing other engineers. Just do your own job in an ethical manner.

Do not try to do too much work at one time. Do fewer jobs and do them well. Concentrate on quality rather than quantity.

Work hard, practice honestly, and refrain from employing high pressure sales tactics.

A consulting engineer has nothing to sell but integrity. If you do a good honest job and don't expect to make a fortune or a fast buck, you will eventually make a good living in one of the world's most fascinating businesses.

Build your reputation on honesty, promptness, and service regardless of profit or loss on a particular job. This doesn't mean you should sell your services for nothing.

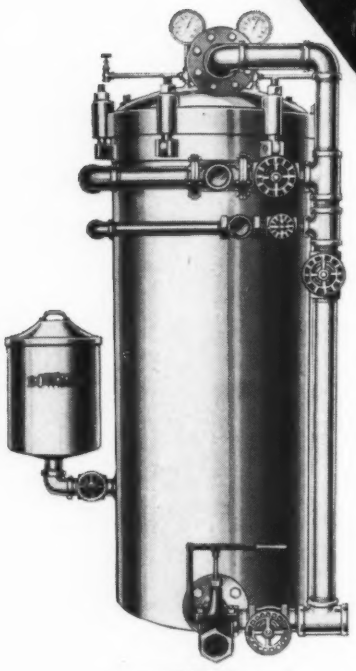
Lean over backwards to be scrupulously honest and reliable. Pay all debts promptly or explain why not. Never hesitate to ask clients to pay, and most important, have lots of good friends.

Know the products and services which you specify thoroughly and assume full responsibility for their effectiveness.

Be honest with your clients and do not give them low cost estimates or false completion dates. Be pessimistic in estimating time required to complete a project.

Emphasize quality of work and build the organization on a slow and stable basis with qualified personnel.

Be cautious of "free" engineering service offered by industry in connection with the sale of their products. ▲▲



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Report from Austria

RUDOLF SOBOTKA
CONSULTING ENGINEER CORRESPONDENT

STROLLING AROUND VIENNA or some other town in Austria, an attentive observer will notice at some houses name plates bearing the emblem of the State—a black eagle with a red and white shield. These plates direct clients to the office of a civil technician. Some 1600 civil technicians presently practicing in Austria are entitled and bound by law to publish the State emblem on their seal, letterhead, and name plate.

Legislation Covering Civil Technicians

The rights and duties of civil technicians have been regulated by a number of laws and decrees, of which the latest dates back to the Royal Patent of December 20, 1859. In two years, therefore, Austria's civil technicians will celebrate the centennial of the legal recognition of their profession.

Austrian legislation recognizes three categories of civil technicians: architects, consulting engineers, and civil engineers. The activities of architects relate to overground workings, especially to the artistic style of a building. An architect may direct and supervise building work but he may not execute it — he may not be a contractor.

Consulting Engineers' Activities

Consulting engineers work in the following fields:

Structural design	Machine design
Electrical engineering	Marine engineering
Kulturtechnik (drainage, sewers, bridges and roads, water distribution)	Forestry
	Mining
	Metallurgy
	Combustion, heating, and air conditioning
Chemical engineering	
Physical engineering	Surveying
	Mine surveying

The Austrian consulting engineer deals only in services. He advises and draws plans and specifications. He may not be engaged in construction. About 450 consulting engineers presently are practicing their profession in Austria, and a spokesman for the Chamber of Engineers, in Vienna, declares that there is neither a shortage nor an excess. The supply seems to about meet the demand. More than half of these engineers have their offices in Vienna or in the surrounding provinces of Lower Austria and Burgenland. The eastern-most provinces of

THE KOLBNITZ HYDRO-PLANT IS ONE OF THE LARGEST AUSTRIAN ENGINEERING PROJECTS OF RECENT YEARS.

Tyrol and Vorarlberg have 17 consulting engineers, all of whom are active as surveyors. Also in Styria and Carynthia, consulting engineers engaged in surveying predominate (60), followed by structural engineers (14).

Surveyors also hold a numerical lead in Salzburg and Upper Austria. In Vienna, consulting structural engineers have a slight lead over surveying, while machine design, electrical engineering, chemical engineering, and combustion engineers follow in that order.

The title of civil engineer has a different meaning in Austria from that assigned it in most parts of the world. The civil engineer works in all of the fields listed for consulting engineers except surveying and mining surveying, but he alone is authorized to turn plans into reality—to engage in construction.

Civil technicians are considered a free professional class such as lawyers and notaries. The authorization for practicing the profession of a State licensed civil technician is bestowed by the provincial government which also administers an oath. In order to qualify as a State licensed civil technician the applicant must meet the following requirements:

¶ He must be 24 years of age and legally entitled to administer his own property.

¶ He must be an Austrian citizen.

¶ He must be a man of good reputation.

¶ He must have a final examination certificate from an Austrian technical university, the Master School of Architecture at the Academy of Fine Arts, or the Master Class for Architecture at the Academy of Applied Arts in Vienna.

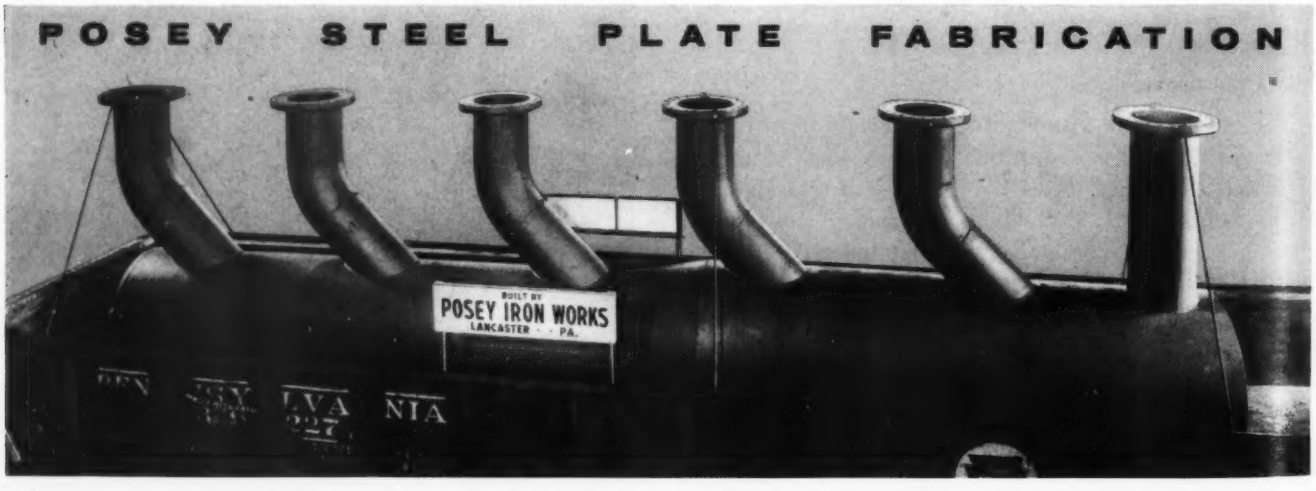
¶ He must practice for at least five years after completion of his studies (four years for applicants who have a doctor's degree).

¶ He must pass the civil technical examination.

¶ He must have the recommendation of the Chamber of Engineers.

After bestowal of the license by the provincial government and the administration of the oath, a civil technician automatically becomes a member of the Chamber of Engineers. Then, in his capacity as a State licensed civil technician, he may act in his special field as an advisor, a director of projects, a technical representative of private clients before courts or civil service offices, or as an expert, valuer, or technical advisor.

For the purpose of representing and furthering the interest of the civil technicians, a law was passed on January 2, 1913 for the establishment of the Chambers of Engineers. Subsequent decrees led to the establishment of such chambers in Vienna, Graz, Linz, and Innsbruck. In 1951, the Vienna Chamber was subdivided into three departments, one for each of the categories of civil technicians.



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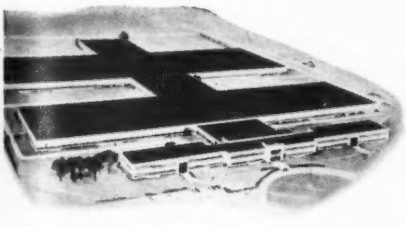

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Spintex offers the fire-stopping advantages duct insulation must have! It will neither burn nor smoulder, and fire simply will not travel along a Spintex insulated duct.

Produced by a new Johns-Manville spinning process—new Spintex® is greatly improved. Its mineral fibres are measurably smaller in diameter and substantially more uniform. This improved fibrous structure adds countless heat-stopping dead-air spaces to every cubic inch . . . helps you maintain comfortable working temperatures at lower operating cost than ever before.

Spintex installs quickly . . . easily!

Spintex is clean, sanitary and "friendly" to handle and work with. It cuts readily with an ordinary knife. And it is easily and quickly installed even where ducts are curved or in difficult-to-reach places.

Spintex improves duct appearance in plant or office

Air conditioning ducts insulated with Spintex are neat and attractive, with trim, tidy joints. To meet unusual conditions or decorative needs Spintex is regularly furnished in a variety of special surfacings.

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The Chamber in Linz introduced this triple division in 1954. Graz has two departments, while Innsbruck still gets along without subdivision.

Parliament is expected to pass, in 1957, new laws having to do with civil technicians and the Chambers of Engineers. These laws will attempt to unify and modernize the scattered legislative actions of former times.

The purpose of the Chambers of Engineers is to represent and further the professional and economic interests of civil technicians, protect the honor of the profession and its members, and give advice on matters of a general professional economic nature. The expenses of the Chamber are covered by membership fees, fixed at the annual meeting. There are also meetings of the members of the Chambers, regular meetings of the presidents of the Chambers and department heads, and meetings of the Court of Honor (for arbitration if differences between members are to be settled).

The Chambers also represent and protect the interests of their members before government authorities and the public. They are consulted on any draft laws that bear on the interests of civil technicians, and they make suggestions on their own initiative to competent State or provincial authorities on matters concerning the interests of the profession. Usually, these dealings have to do with State work contracts or engineering work being done for any of the provinces or districts.

The Chambers may place collective advertisements for their members in catalogs, directories, or periodicals of a technical or scientific character. It is also their duty to protect their members against unfair competition by unauthorized persons.

The establishment of fees of the various categories of civil technicians and the securing of approval of these fees by the Ministry of Trade and Reconstruction is also part of the Chamber's duties. From time to time the fees are revised in order to adjust them to the economic situation. After approval by the Ministry, the fees become valid for the whole of Austria. The present fee schedule soon may become invalid, as new rates have been submitted to the Ministry of Trade and Reconstruction and approval is expected early in 1957.

The calculating of fees under this schedule is anything but simple. The fee schedule is printed in a little booklet containing a maze of regulations, definitions, and tables that are supposed to assist the consulting engineer attempting to determine his proper charges. It is not uncommon, however, for the consulting engineer to consult with the Chamber before writing out his bill for a client.

We see, then, that consulting engineers in Austria have behind them a century of standing and tradition, but along with their special privileges they are subject to definite legal regulation. ▲▲

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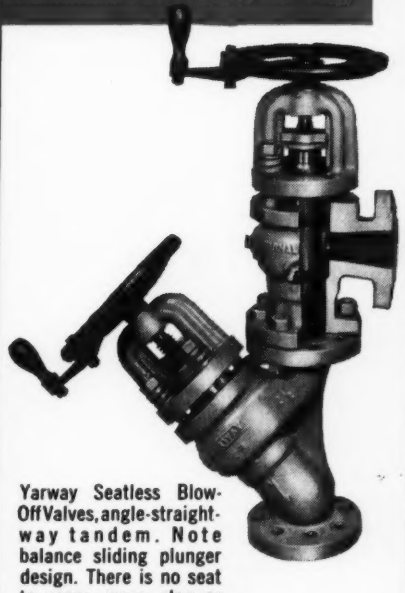

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* *Mr. Entropy represents the heat that is produced but unavailable for use.*

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Notes From Abroad

New Shuttering Techniques

Two methods of shuttering for concrete structures have been developed in Europe to reduce overall cost of construction. The Forest Products Research Laboratory of the Department of Scientific and Industrial Research, England, has found that with plywood bonded with a moisture resistant glue, preferably of the phenolic type, lighter than timber planks and available in greater widths, large areas can be covered more quickly. Plywood ½ to ¾ in. thick is suitable for flat construction, with 3/16 to ¼ in. for curved work.

In designing shuttering of the normal type the spacing of the studs and wales must be such that the plywood is able to resist lateral pressure of the poured concrete without undergoing local deflection. Water putty is recommended for sealing edges of the plywood sheets and also the butt joints between the sheets. If working faces of the shuttering are brushed before use with a light viscosity mineral oil, subsequent stripping and cleaning is facilitated. With careful handling and storage, plywood shuttering can be used many times. The laboratory reported one instance in which it was used 110 times before being discarded.

In Austria, the wood construction works of Hopferwieser have developed an economical and practicable shuttering sheet with the trade name Doka that has no frame. The Doka sheets are connected by dovetailing, glued with waterproof glue, planed, and then reinforced with special sections at the front. Size is 50 x 150 cm (approximately 20 x 60 in.). Breaking strength is about 1300 kg (2860 lb) at a free bearing length of 5 cm (29½ in.), with a tearing strength of sections protecting edges of about 6600 lb.

In spite of the higher costs of these sheets compared with ordinary shuttering boards, total cost of shuttering can be reduced by about 65 percent with use of the sheets, because of reuse (at least 50 times), and reduction in labor time.

Sandstone Foundations

In the town of Raisen, Bhopal State, India, an Indian engineer, Major Fahim Beg, has designed and supervised construction of a residential bungalow, a high school, and a hostel with special foundations that he developed for use on the black cotton soil native to the region.

Capillarity of the soil, its loose texture, and high porosity have made it necessary to excavate to a depth of about 25 ft before laying conventional foundations for buildings. Even with these precautions, buildings frequently cracked as a result of heavy rainfalls or severe dry spells.

Beg's foundation is made of local red sandstone that has been dressed to blocks about 18 in. high. The blocks are stacked on the foundation site to cover the area on which the building will rise. The layer of blocks is watered and pressed down into position with the aid of steam rollers. This forms a base on which to put the building. The system cuts construction costs as much as 40 percent in some instances.

Suspension Bridge Economies

The 1290-ft-long suspension bridge built by Westcoast Transmission Co. at Shelley, British Columbia, to carry a natural gas

7 REASONS WHY

Hartzell Vaneaxial Blowers

- LAST LONGER
- DO A BETTER JOB

Belt-drive model (shown) available in sizes from 12" to 54", standard or high-temperature construction. Also available in direct-drive models, 18" to 42". These blowers operate efficiently against pressures as high as 10", deliver up to 87,000 CFM. For complete details, write for Bulletin A-110 or call your nearby Hartzell field engineer.

- Heavier gauge steel throughout — outer shell steel ranges from 14 gauge on 12" models to ¼" plate on 54" models — to evaluate strength of construction, compare net weights before you buy.
- Precision-cast, aluminum alloy impeller, dynamically balanced to prevent vibration.
- All-welded construction — guide vanes are welded to both inner and outer shells — there's nothing to work loose and vibrate.
- Certified ratings—all Hartzell blowers are tested for air deliveries according to the Standard Test Code.
- Easy maintenance—ball bearing pillow blocks are Alemite lubricated from outside the duct section — belts can be changed by removing one small plate.
- Belts totally enclosed to prevent damage by elements in the air stream . . . yet easily adjusted by turning two bolts.
- Top quality motors supplied by nationally recognized manufacturers.

Why You Can Count on Hartzell Air-Moving Equipment for Long Life, Rugged Reliability and Minimum Maintenance

Hartzell fans and blowers are engineered and built for the exacting requirements of tough industrial service. There's no compromise with quality for the sake of shaving a few dollars on price. Hartzell fans are designed for the industrial buyer who is willing to pay for long life, dependable service and low maintenance.

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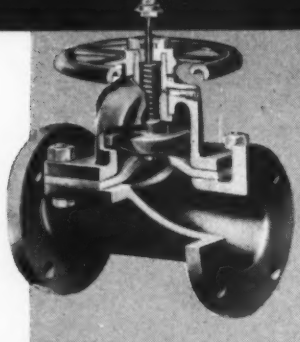

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Hills-McCanna Diaphragm Valves are available in a variety of materials to offer positive control for all gas, liquid and corrosive services. Features simplified, maintenance-free construction. Write for 12 page Valve booklet.

Hills-McCanna Company 2446 W. Nelson Ave., Chicago 18, Illinois

transmission line, was built more economically by departing from conventional design of rigging arrangements and masts. A guide tower mounted on a ball and socket supports the main cables. Independent masts support wind cables. These features were found to be more economical than A-frames with wind arms.

Joint consulting engineers were Robert McLellan & Co., Ltd. and Choukalos, Woodburn, Hooley & McKenzie, Ltd., both of Vancouver, B.C.

Mine Construction

Engineers at the Bancroft Mine in Southern Rhodesia, South Africa, that is scheduled to go into production early this year, ran into a sea of mud 300-ft below the surface as the workings approached the ore body. Cementing, freezing, and sinking of a new shaft were considered. Only cementing was economically feasible, but cement would not hold because of the amount of sand present.

The solution was a 10-ft diameter steel tube made up in sections that could be assembled underground. Cement was injected to congeal the mud temporarily, a section excavated, and the first length of steel tube put in place. The second length was brought through it, to be assembled as the next section of mud was dug out after cementing. At the 400-ft level firm rock was struck, but at 550 ft another mud stratum was found and dealt with in the same way as the first.

Computer Center for Belgium

An Analog Computation Center will be opened in Brussels, Belgium, this summer by Electronic Associates, Inc., Long Branch, N. J. Management operations control, dynamic systems analysis, and applications engineering also will be available at the new Center.

To each problem, the Center will assign the necessary scientists, engineers, or mathematicians experienced in the use and applications of analog computers to evaluate, set up, and solve problems submitted. Plans are to staff the Center with as many European scientists as possible. When

CONSULTING ENGINEERS SPECIFY

SPEEDLINE STAINLESS STEEL FITTINGS

FOR POWER PLANT PIPING SYSTEM

● Cut Materials and Labor Costs...

● Solve Leakage and Corrosion Problems!

A high degree of water purity is a must for efficient operations at Pennsylvania Electric Company's Shawville Station. Neutralizing and demineralizing a highly acidic water supply demands positive protection from contamination and corrosion. Careful study of all available piping materials led Gilbert Associates, consulting engineers, to specify low cost light wall stainless pipe and Speedline Fittings for *both* boiler feed lines *and* water make-up lines!

Elimination of contamination and corrosion problems plus savings in materials costs, installation time and maintenance-free system performance *proved* the wisdom of the choice. Speedline insert flanges eliminated costly back welding. Exclusive design features of Speedline tees, aligning connectors, reducers and elbows reduced installation time. *Every* joint proved 100% leak-proof!

Three years of trouble-free service has earned for Speedline Fittings the complete satisfaction of Shawville's plant superintendent.

There are other piping design and assembly advantages possible *only* with Speedline Fittings. Get the *complete* facts for your application by writing for a copy of "Speedline Fittings" today. Or discuss your requirements with the Speedline representative nearest you.

700

Speedline®

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STAINLESS STEEL FITTINGS

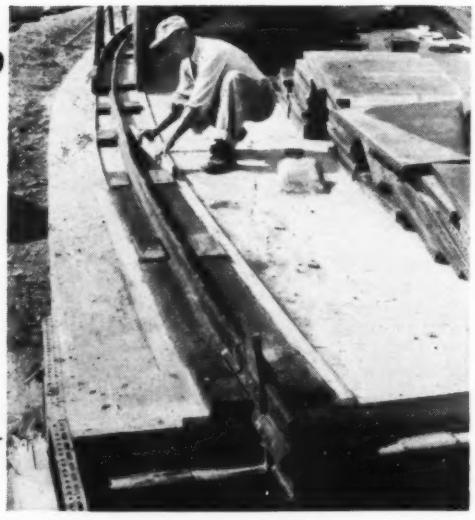
THE NEWEST THING IN PIPELINE ECONOMY

SPEEDLINE DISTRIBUTORS ARE LOCATED IN PRINCIPAL CITIES FROM COAST TO COAST

Manufactured by **HORACE T. POTTS COMPANY** • 522 E. Erie Avenue • Philadelphia 34, Penna.

How to Choose Waterstop

for optimum performance in Water and Sewage Treatment Plant Joints



Ultimate Elongation, Retention in Concrete Most Important Factors

The principal function of waterstop is to keep concrete joints watertight where hydrostatic water pressure is present, and where movement of the concrete tends to open the joint.

To be effective, and to perform its function, the waterstop must:

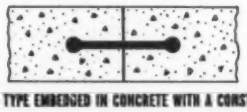
1. **Be made of a material which has high tensile strength and permit maximum elongation without losing its elasticity. This is referred to as "ultimate elongation."**
2. **Be made of a material which permits a good concrete bond.**
3. **Be designed in such a way that concrete can make full contact with, and assure good retention of the waterstop during movement of the concrete.**

Many materials and designs in waterstop have been developed. Today, the most widely used materials are rubber, neoprene and polyvinylchloride. Designs vary with individual manufacturers and each design has its adherents. There seems to be, however, general agreement by many governmental and private specifying authorities, after years of testing and actual installation, that the rubber material and the dumbbell design (below) offer more advantages because of its inherent tensile strength, ultimate elongation, ability to bond with concrete, superior retention in the structure during contraction, and because of its comparatively low cost.

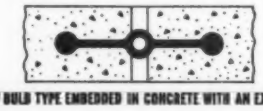
Proponents of the polyvinylchloride material claim, quite correctly, that it is superior to rubber from the point of oxidation and weathering and resistance to chemicals and oils. This is a negligible factor 95% of the time, because only about 5% of waterstop installations present the situation where the material is subject to weathering, chemicals, etc. The rest of the time, the waterstop is buried in the structure itself.

Where waterstop is exposed, manufacturers of the dumbbell type offer it in polyvinylchloride or neoprene.

Retention of the waterstop in the joint during contraction or settling of the structure is another important consideration in choosing a type for your specific application. It is here that the dumbbell design is demonstrably superior to any other which has been developed to date. The design of the dumbbell is such that, when the concrete contracts and the joint opens up, the outer dumbbell edges become more tightly engaged with the concrete, making a tighter seal as the tension increases due to movement either in the joint or increasing water pressure on one side of the joint.



9" DUMBBELL TYPE EMBEDDED IN CONCRETE WITH A CONSTRUCTION JOINT



9" HOLLOW BULB TYPE EMBEDDED IN CONCRETE WITH AN EXPANSION JOINT

Field Splicing of Dumbbell Type

Servicised Products Corporation has developed a new Union which provides a simple method of joining the ends of dumbbell waterstops, making it just as fast and easy to field splice rubber and neoprene waterstop as the joining of the polyvinylchloride types.

The Union is made in the same cross-section, and from the same material as the waterstop. It is hollow, except for a solid web at the center. After adhesive is applied to the waterstop ends, they are inserted in the Union and pushed against the centering web. This completes the splice.

Dumbbell type rubber and neoprene waterstop are fully described in a special Waterstop Circular available from Servicised Products Corporation upon request. The Union and an interesting new development, Split Type, are also illustrated and described in the circular. Write for it today.

SERVICISED PRODUCTS CORPORATION
6051 W. 65th Street, Chicago 38, Illinois

individual situations require specialized aid, the staff will be augmented by experts from various research institutions and universities in the area and from Electronic Associates. These specialists will follow the problem from the initial stages of preparation and analysis, through the processing of the problem in the E. A. Analog Computer, and to the final analysis of the results of the computation. They then will prepare a comprehensive report with specific recommendations.

Trans-Canada Highway Progress

More of the Trans-Canada Highway was built in 1956 than in any previous year, according to Canadian Public Works minister, Robert Winters, who attributed the progress to increased provincial highway construction programs linked with the Government's gap-closing formula that provides special financial incentive to provincial governments.

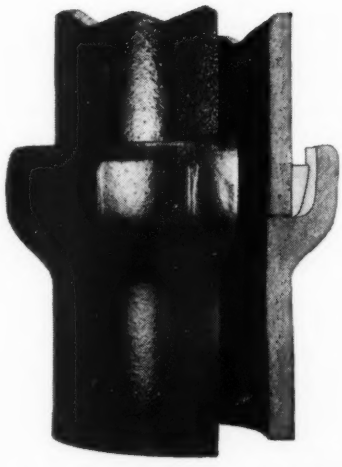
The Trans-Canada Highway Act of December, 1949, as amended in 1956, authorized the Federal Government to pay 90 percent of the cost of construction on 10 percent of the mileage in each province and extended the construction period to December 31, 1960. It also increased the amount of federal funds available for payments to the provinces from $150 million to $250 million.

A total of 436 miles was approved for grading during the year and 341 miles of grading was completed. Approximately 300 miles of paving was approved for construction and 356 miles were completed. This latter figure includes a carryover from the previous year. Of the total of 4480 miles along the Trans-Canada Highway, approximately 2735 miles are now paved and 1536 miles have been completed to T-C Highway standards.

Earthquake Resistant House

Soviet engineers are constructing an earthquake resistant experimental house in Ashkhabad, the town that was partially destroyed by a severe earthquake in 1948, and is now being rebuilt. The foundation of the house is made up of a frame suspended on

Neither Rain, Nor Sleet, Nor Mud . . . slowed the installation of this AMVIT* LINE



If you can dig the trench, you can install Amvit Jointed Clay Pipe. Bad weather and mud won't slow the laying of an Amvit line.

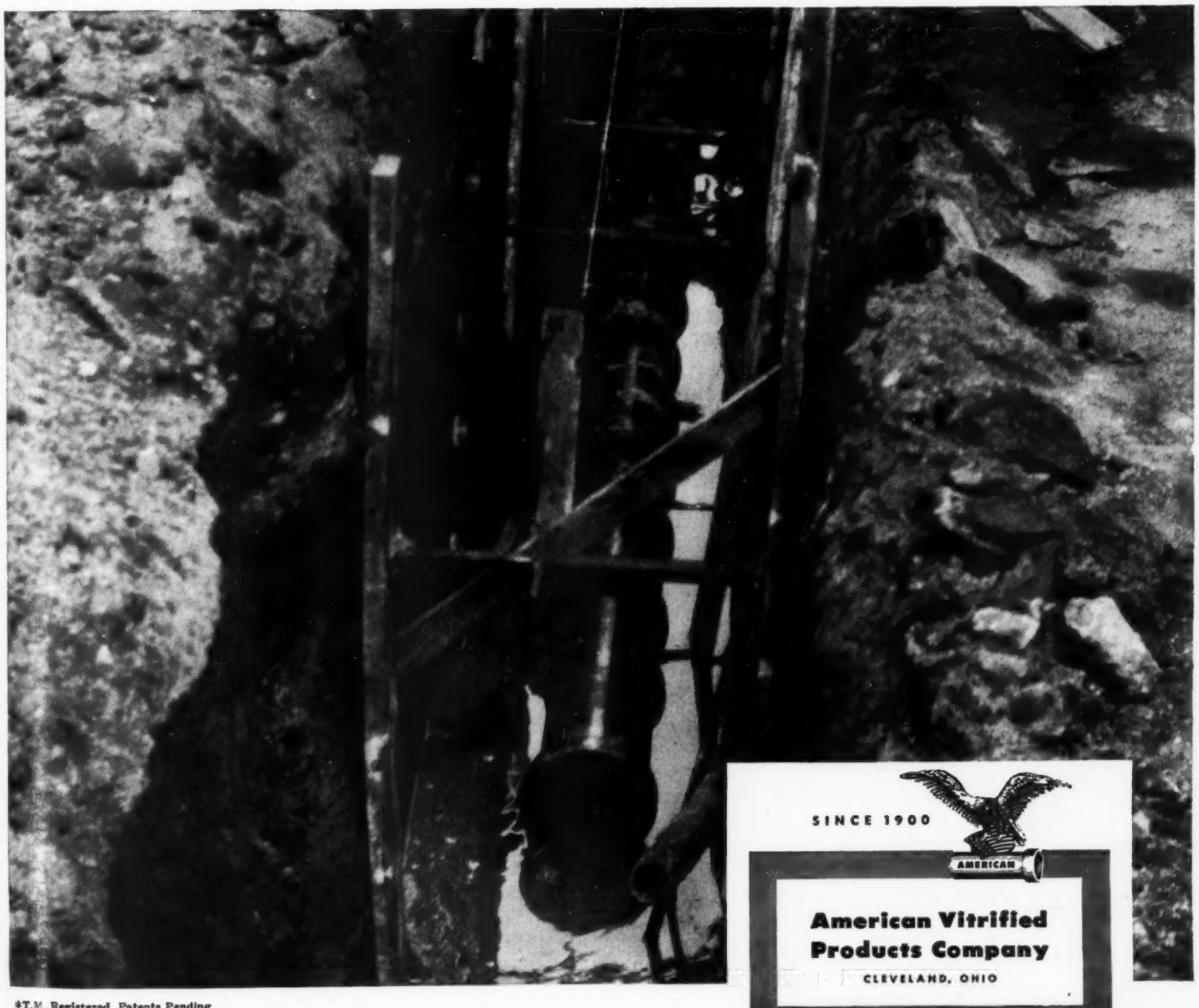
The joint is on the pipe delivered to the job ready for use. Nothing else is needed. Just push the pipe together and the joint is complete.

No other materials such as caulking, joint compound, joint runners, hot-pots, or ladles are needed to make the Amvit Joint. Savings on materials and labor mean *lower cost of pipe in place.*

Amvit is a compression type joint on the ball and socket principle. No adhesives or other compounds are needed to make a tight seal. Once the joint is complete, nothing can enter or leave the line.

Amvit Jointed Clay Pipe, in sizes 4" through 24", together with all fittings, is available for immediate delivery in the Northeast and Central States.

For more information and our new Amvit brochure, write or call American Vitrified Products Company, National City Bank Building, Cleveland, Ohio, or our office nearest you.



SINCE 1900

AMERICAN

American Vitrified Products Company

CLEVELAND, OHIO

*T.M. Registered, Patents Pending

The Amvit joint is made of an acid resistant plastic material with rubber characteristics. Like the pipe, the joints will not be harmed by any condition of underground service. The pipe is simply pushed together. The trench is then ready for backfilling.

MANUFACTURERS of: Clay pipe, flue liners, clay liner plates and concrete pipe.

Plants Across the Nation... Brazil, Indiana • Chicago, Illinois • Cleveland, Ohio • Crawfordsville, Indiana • Detroit, Michigan • East Liverpool, Ohio Fenton, Michigan • Grand Ledge, Michigan • Lisbon, Ohio • Los Angeles, California • Milwaukee, Wisconsin • South Bend, Indiana • Uhrichsville, Ohio

CADWELD®
solves
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connector
problem

of connecting two—
350 MCM copper cables to three—
250 MCM flexible copper braids. The braids
in turn are connected to 1-1/4" nichrome rods.
CADWELD'S versatility of design and outstanding electrical properties solved the problem.

YOUR electrical connection problem due to:

1. Conductor construction
2. Type of conductor material
3. Overload and surge currents
4. Corrosive conditions
5. High ambient temperature

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2070 E. 61st Place · Cleveland 3, Ohio

IN CANADA: ERICO INCORPORATED, 3571 Dundas St., West, Toronto 9, Ontario

iron brackets with springs and placed on a wooden base, with a second frame installed on top of it. Walls of the house are built on the second frame. The Russians claim that ordinary brick laying and conventional building materials can be used and that a three-story house will not be jarred by even the strongest earthquake.

Automation in Russia

In a review of the progress made by Soviet industry in use of automation, S. P. Krasilsky, deputy head of the Department of Apparatus and Production Automation, stated that automation of blast furnace operations in the iron and steel industries increased efficiency of the furnaces by seven to eight percent and resulted in a four to six percent saving in fuel. Other claims were that all major hydroelectric power stations are now operated by push button controls, frequently from a control center for the entire grid.

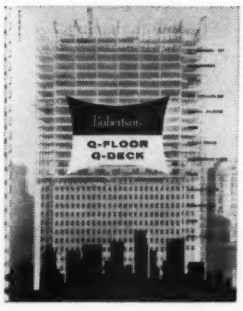
Integrated automatic production lines have gone into operation in recent years and a fully automatic plant for manufacture of pistons is in operation. At the No. 1 Bearing Works in Moscow, production has doubled since introduction of automation, and product quality has improved. Almost 92 percent of the ball bearings from the two integrated automatic lines started in 1955 are now classified as high quality. Next task of the Soviet planners is the change of automation of separate operations to integral automation of a whole sequence of operations, and ultimately full automation of industry.

Engineering Aid to Korea

Smith, Hinchman and Grylls Associates, Inc., Detroit, Mich., will act as administrator and coordinator for a team of six American companies that will spend two years aiding the Republic of Korea in reconstruction and stabilization of its economy.

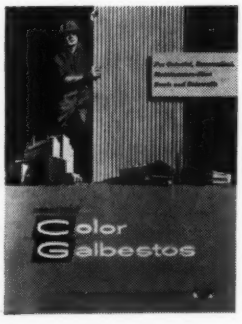
Under the contract, involving $3½ million from International Cooperation Administration funds, engineers and specialists from the firms will supply guidance and service to Syngman Rhee's gov-

Write- for these free books from H. H. Robertson Company's technical library



1.
New Composite Q-Floor—Q-Deck Catalog:

Catalog contains technical data on all phases of cellular steel floor and roof deck construction. Structural details and specifications are more complete than ever before.

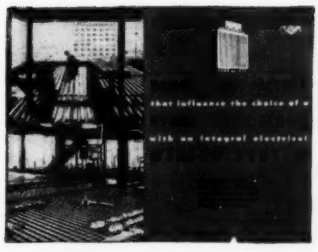


2.
Color Galbestos:

Complete details and specifications on this maintenance-free roofing and siding now available in colors. Catalog shows the four new colors in addition to the standard black and maroon.

3.
Ventilation Engineering Booklet:

More than a ventilator catalog, this booklet contains tables of exhaust capacities, based upon average wind velocities, temperature differences and height above intake. Use the coupon below.

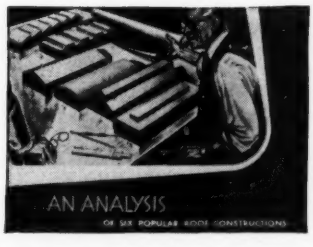


4.
Design and Cost Factors

This book compares Q-Floor with other types. Based upon a typical multi-story building, the study is replete with charts and cost analyses of all structural components.

5.
How to Fireproof Q-Floor and Structural Steel

This is a description of fireproofing methods when Q-Floor is used with structural steel framing. It contains detailed drawings, typical code requirements and fire resistive ratings.



6.
An Analysis of Industrial Roof Construction

All the better-known roof types (flat, monitor, bow-string, double-pitch, high-low bay, saw tooth) are compared on the basis of weight of structural steel, volume, roofing, sash area, flashing, ventilation and daylighting.

Robertson Products
for modern buildings

H. H. Robertson Company
2431 Farmers Bank Building, Pittsburgh 22, Pa.
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Offices in Principal Cities

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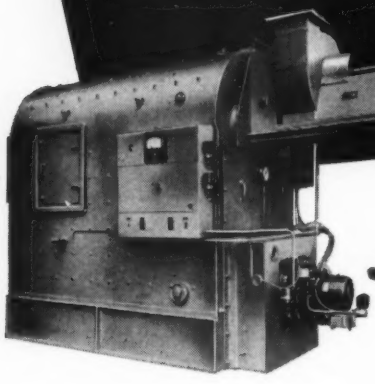
Faster and Cheaper
plus
Convertibility to
Coal Firing



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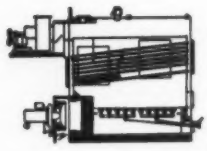
Water Tube
Package Boilers

Combine the proven advantages and economies of International water tube boiler design . . .

- **Ample Furnace Volume—low heat release rates**
- **Reserve Capacity Always Available**
- **Maximum Heat Absorption—quick steaming**
- **Induced Draft—quiet operation**

with fully coordinated burner and controls, and you have an International Water Tube Package Boiler



Shipped as a complete unit for oil, gas or combination firing, this firebox boiler can be easily converted to coal firing at any time.

International Package Boilers can also be shipped, less burner and controls, for installation by local contractors in accordance with International's package boiler specifications.

Get the full story on International Water Tube Package Boilers. Write today for Bulletin 600.

Exclusive territories open to experienced sales organizations. Write stating qualifications.

IBW

BOILER BUILDERS SINCE 1886

THE INTERNATIONAL BOILER WORKS CO.

Steel Firebox Heating & Power Boilers • Low & High Pressure Water Tube Package Boilers • International-LaMont Forced Recirculation Generators • ASME Code Pressure Vessels & Welded Products

800 Spruce St. East Stroudsburg, Pa.

ernment and the ICA in transportation, mining, electric power, public works, tele-communications and general industry.

In the joint venture are Smith, Hinchman and Grylls, administration, general industry, and public works; Commonwealth Associates, Inc., Jackson, Mich., electric power and public works; Brown and Blauvelt, New York, public works and transportation; Paul Weir Co., Inc., Chicago, Ill., mining; Page Communications Engineers, Inc., Washington, D.C., communications; and Commonwealth Services, Inc., New York, management and training programs.

Chester J. Clark, an architect and engineer with SHG since 1954, will be in charge of the work. Clark and Ansbert G. Skina, senior consultants with Commonwealth Services, recently returned from a preliminary survey of Korean problems, during which they received approval of the proposed firms from Rhee and his advisors.

Other businesses and industries are on a standby basis to serve if needed later in such varied fields as textiles, chemicals, plastics, fertilizers, cement, and leathers.

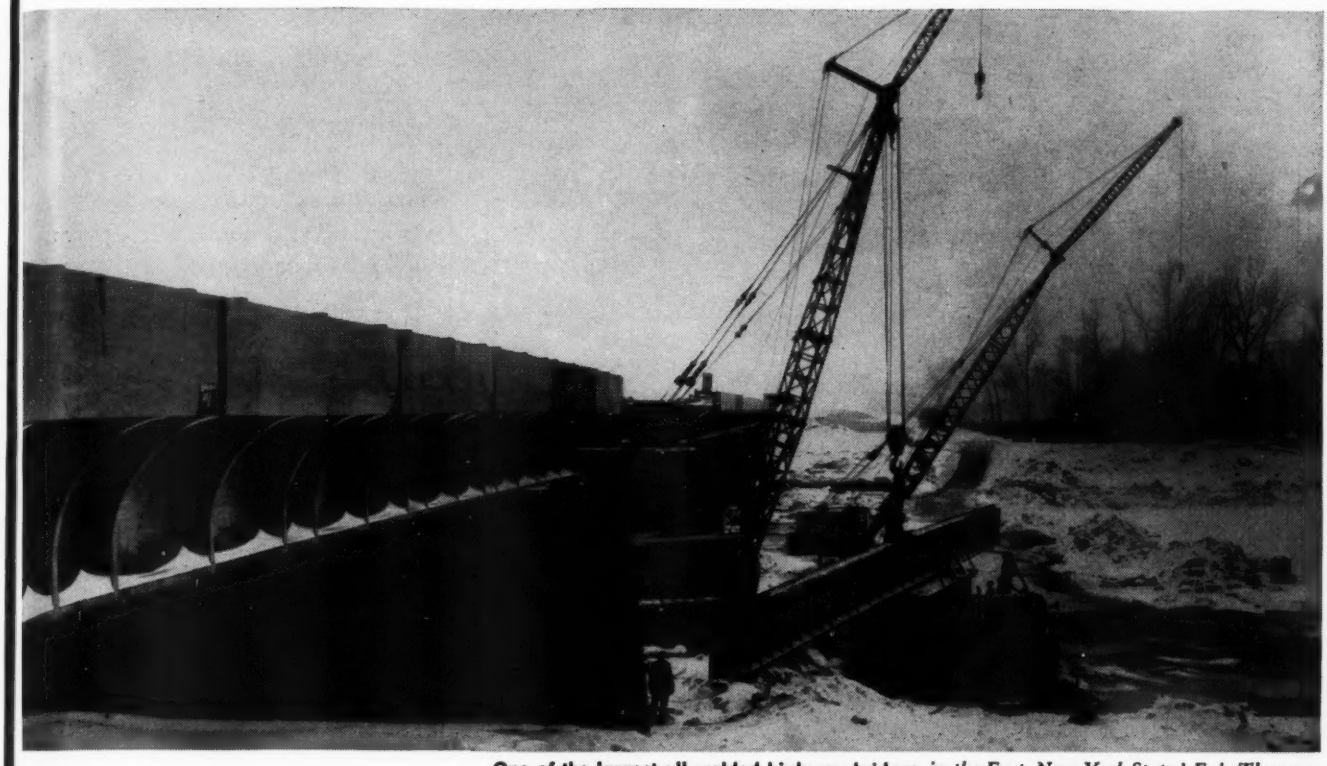
Cement for South Africa

A large expansion plan has been formed for the cement industry in South Africa, with an outlay of about $12 million. Pretoria Portland Cement proposes to install an additional kiln with a capacity of four million pockets of cement a year. The Cape Cement Company plans to build a complete cement factory at a location where the company has a large limestone quarry.

A limestone mining license covering an area of some 7000 acres at Nkalagu in Ogaja Province has been granted to the Nigerian Cement Co., Ltd., the company now erecting a new factory for manufacture of cement.

Inflatable Piping

A new type of pipe, capable of carrying oil, gas, or water, is under test in the USSR. Made in the form of two flat, tough steel strips electrically welded along the edges, the pipe is laid by un-



One of the largest all welded highway bridges *in the East. New York States' Erie Thruway over Cattaraugus Creek. Carries six traffic lanes, has center mall and safety walks on both sides.*

ALL-WELDED HIGHWAY BRIDGE DESIGNS

...take less steel, built for lower cost

Composite action *of reinforced concrete slab and steel girders is made possible through ⅝" steel spirals welded to top of girder flange.*

SUBSTANTIAL savings in steel and cost are being realized by the use of welded design in the construction of highway bridges by State Departments throughout the country.

This structure which carries the New York State Thruway across Cattaraugus Creek is composed of five 132 foot spans. The 8-inch reinforced concrete roadway slab is attached to the steel girders to provide composite action between structural materials of different characteristics. The slab is tied to the top flanges with 6-inch spirals of ⅝-inch steel welded to the girder flanges to take horizontal shear.

This bridge is one of hundreds of welded structures designed and built by the Department of Public Works of New York State. Savings average 15% to 20% in steel and construction over similar steel riveted structures.

Structural Engineers send for Studies in Structural Arc Welding giving data on welded bridge design. Write

THE LINCOLN ELECTRIC COMPANY

Dept. 5801 Cleveland 17, Ohio

The World's Largest Manufacturer of Arc Welding Equipment

When bridge designs can be simplified

Have better appearance...require less maintenance...

Yet cost less to build...

WHY shouldn't you design more for welding

PENNSYLVANIA PLANT LOCATION DATA SERVICE

Special reports and tabulations, tailored to stated location requirements, will be prepared upon request by our engineering and economics staff from central data, files and direct sources, covering:

LABOR—Availability, skills, rates, surplus areas.

MARKETS—Consumer, industrial product, state, regional.

TRANSPORTATION—Water, rail, truck, air transit time, costs.

FINANCING—Community-state industrial building program, lease-purchase, commercial credit.

BUILDINGS—Availability, sizes, location, descriptions.

SITES—Acreage, topography, utility services, photos, maps, industrial districts.

MATERIALS—Metals, industrial chemicals, wood, textiles, farm products.

MINERALS—Location, reserves, potentials, analyses.

WATER—Quantitative, qualitative analyses.

POWER—Capacity, network, industrial service, costs.

FUEL—Coal, oil, natural gas service, costs.

ENGINEERING—Schools, enrollments, specialization, research laboratories, services.

TAXES—Inter-state and community comparisons, assessment ratios, millages, corporate.

COMMUNITIES—Characteristics, size, regions, housing, schools, culture, recreation.

Industrial Representatives Available For Inspection Tours, Conferences And Consultations

For free copy of "Plant Location Services" pamphlet, or for more details on 100% financing, write or call:

PENNSYLVANIA DEPARTMENT OF COMMERCE
Main Capitol Building, 493 State Street
Harrisburg, Pennsylvania
Phone: CEdar 4-2912

rolling it from a moving lorry. When laid it is inflated by air to assume a cylindrical shape. The tubes come in sections one kilometer long and are capable of withstanding a pressure of 15 atmospheres. The steel strips are from two to four millimeters in thickness, compared with the six to nine millimeter thickness of conventional tubes.

Materials Handling Equipment

Societe Comessa at Schiltigheim (BasRhin), France, is manufacturing a new vibratory transporter that sorts and grades materials during transport. The sorting feature of the equipment has been designed to give maximum efficiency in relation to the size of the sorting surface, depth of materials layer, and sizes of the material by an easily adjustable control of the intensity and direction of vibration, which is dampened by the elastic suspension. A new system for amplification of vibration positively eliminates clogging. The horizontal plane of working does away with any loss of height between the feed level and the storage bins.

Multi-Purpose Buildings

The new Tokyo Empress Culture Hall is an outstanding example of the extent to which Japan has developed the concept of multi-purpose buildings. It includes four separate theaters, a lavish shopping arcade, a beauty parlor, and a fully equipped planetarium. The planetarium is one of two in the nation.

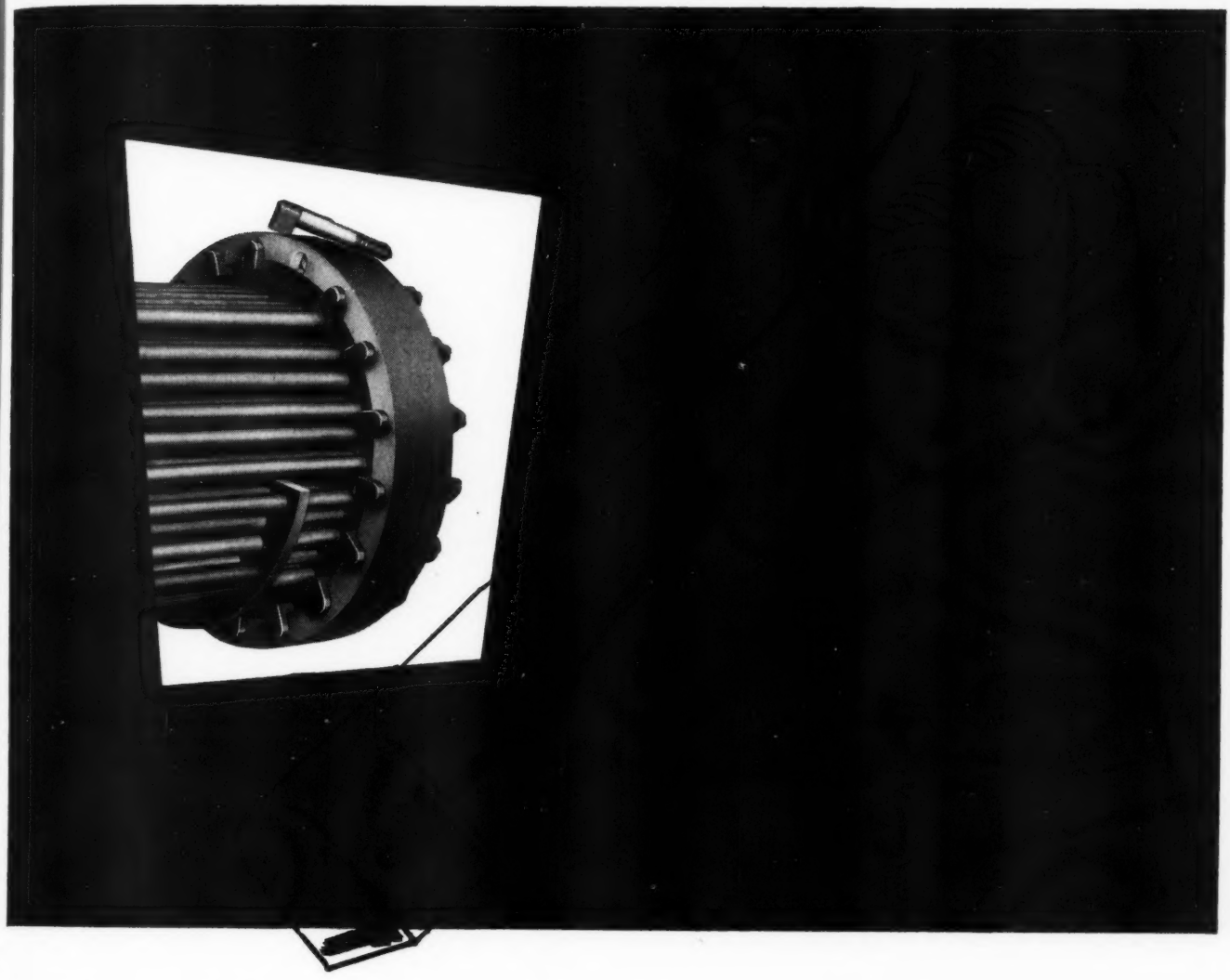
New French City

City planners, engineers, and architects are designing a new city to be located about six miles north of Paris on a 345 acre plot. Planned for 30,000 people, the town will contain 5000 dwelling units, a town hall, railroad station, post offices, a fire station, schools, banks, a hospital, and a stadium.

The self-sufficient community is expected to cost about $34 million when completed in 1960.

Grounds around public buildings will be landscaped and streets planned for efficient traffic control.

First stage, construction of 1200 homes, is already under way.



This Ell Bolt is the Key to leak control

The patented Ell Bolt construction employed on Vogt floating head heat exchangers is the answer to re-assembly without distortion or leak development.

Cover may be removed by simply loosening the Ell Bolt nuts and disengaging the Ell Bolt heads from the "lock notches." No misplacing of Ell Bolts can result — and tightening is easy and positive — absolutely leak proof. Send for Bulletin HE-6. Address Dept. 24A-XCE.

Vogt

HENRY VOGT MACHINE CO., P. O. BOX 1918, LOUISVILLE 1, KY.

SALES OFFICES: New York, Chicago, Cleveland, Dallas, Philadelphia, St. Louis, Charleston, W. Va., Cincinnati,

OTHER VOGT PRODUCTS
Drop Forged Steel Valves, Fittings and Flanges in a complete range of sizes • Petroleum Refinery and Chemical Plant Equipment • Steam Generators • Heat Exchangers • Ice Making and Refrigerating Equipment.

HEAT TRANSFER EQUIPMENT

News for the Consultant

Asphalt Institute Reduces Number of Paving Grades

After a series of exploratory discussions with asphalt users, highway officials, and refinery representatives, The Asphalt Institute has adopted a reduction in the number of grades of paving asphalts from nine to five.

Four basic paving grades now officially recognized by the Institute are listed as 60-70, 85-100, 120-150, and 200-300 penetration. A fifth grade of 40-50 penetration is recommended for special and industrial uses. The accompanying table shows the characteristics and specification limits of the five grades.

Eliminated from the table were grades in the intermediate ranges: 50-60, 70-80, 100-120, and 150-200 penetration. The penetration value defines the consistency of the asphaltic cement, ranging upward from hard to very soft.

The reduction in the number of grades of paving asphalts follows similar action three years ago by the Institute in initiating a reduction in grades of emulsified asphalts from six to four. A project committee of the Institute is currently working toward a reduction of grades of the rapid-curing, medium-curing, and slow-curing groups of liquid asphalts.

Council Directors Meet in Atlanta

The Board of Directors of the Consulting Engineers Council met in the Biltmore Hotel in Atlanta, Ga., on Friday and Saturday, Feb. 8-9, and through their actions changed opinions into policies and succeeded in solving many of the problems of organization of the new federation. All twelve of the state or regional association members of the Council were represented by their directors, and there were also observers from Texas, Illinois, North Carolina, and Alabama. Upon acceptance of Oregon's application for membership in the Council, the representative from Oregon became the thirteenth member of the Council's Board of Directors and participated in the the activities of the meeting as a full member.

John K. M. Pryke, of the New York Association, presided, as current President of the Council, conducting a meeting that acted rapidly and firmly on the matters brought before it.

Perhaps the most critical matter presented to the group was adoption of a dues formula that would be

SPECIFICATIONS FOR ASPHALT CEMENTS

Characteristics	ASTM Method	Industrial And Special	← Paving →			
Penetration, 77 F, 100 g, 5 sec	D 5	40-50	60-70	85-100	120-150	200-300
Flash point (Cleveland Open Cup), F	D 92	450+	450+	450+	425+	350+
Loss on heating, 325 F, 5 hrs, %	D 6	1-	1-	1-	2-	2-
Penetration after loss on heating 77 F, 100 g, 5 sec, % of original	D 5	70+	70+	70+	70+	60+
Ductility — at 77 F, cms	D 113	100+	100+	100+	60+	
at 60 F, cms	D 113					60+
Solubility in carbon tetrachloride, %	D 4*	99.5+	99.5+	99.5+	99.5+	99.5+
Temperature of use — for spraying, F		275-350	275-350	275-350	275-350	275-350
for mixing, F		275-325	275-325	275-325	275-325	200-275

*Except that carbon tetrachloride is used instead of carbon disulphide as solvent, Method No. 1.

Readily Available Westinghouse Fans
Meet your Fume and Dust Removal Requirements

Whatever your air handling problem . . . smoke, fumes, vapor, dust, wood shavings, granular material or ventilating . . . these Westinghouse fans are designed to handle or remove them . . . efficiently and economically.

INDUSTRIAL FANS (Steel Casing) . . . high efficiency for general Air Handling; fume and dust removal; 11 sizes, each with 3 types of wheel for specific applications. Wheel diameters 19″ to 64″; inlet diameters 11″ to 37″.

INDUSTRIAL FANS (Cast Iron Casing) . . . ruggedly built, corrosion resisting. For low volume fume or dust removal, materials conveying, industrial drying and cooling. In 10 sizes, each with 3 types of wheel for specific applications. Wheel diameters 8″ to 34″; inlet diameters 4½″ to 18″.

VENTILATING SETS (Direct-Connected) . . . compact, efficient, ready-to-run. Especially suited for small ventilating installations. Cleanable radial blade wheel minimizes problem of handling airborne dirt and grease. Six sizes. Wheel diameters 6″ to 15″; inlet diameters 6″ to 14″.

VENTILATING SETS (V-belt driven) . . . self-contained. Install indoors or outdoors in a wide variety of heating, ventilating or air conditioning applications. Twelve sizes. Wheel diameters 9″ to 30″; inlet diameters 10″ to 32⅞″.

These leading industrial distributors stock Westinghouse Ventilating Sets and Industrial Fans

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J-80619

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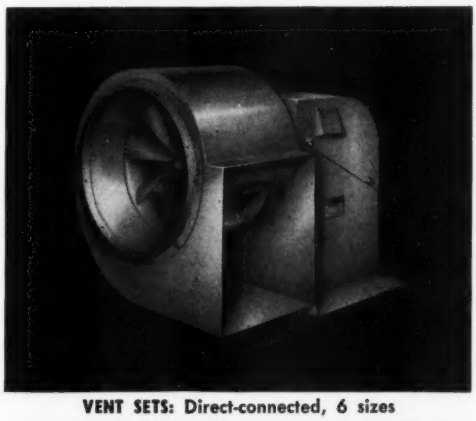
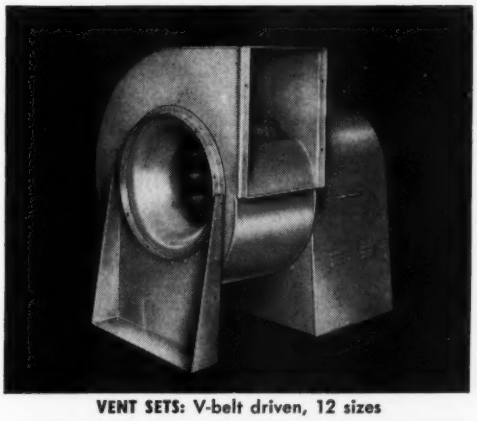
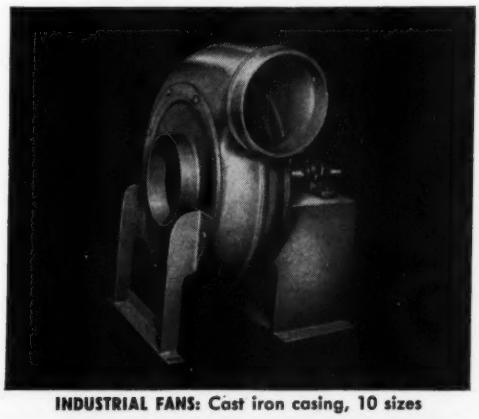


VENT SETS: Direct-connected, 6 sizes



VENT SETS: V-belt driven, 12 sizes



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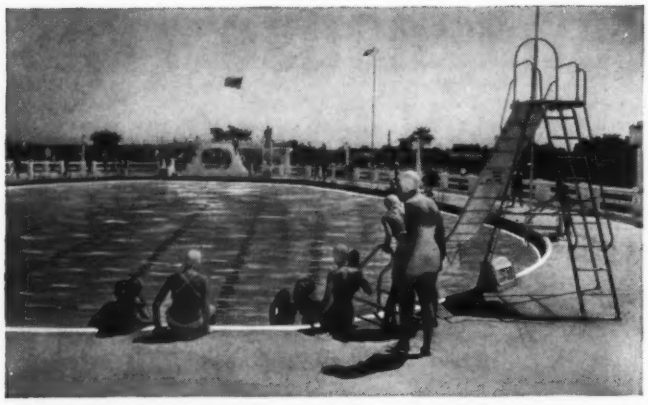

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Hundreds of swimming pools across the nation have found that Adams filtration packages are the right answer. That's because of the advanced engineering design . . . diatomite filtration . . . permanent Poro-Stone elements . . . compact installation . . . simple operation featuring a new backwash technique.

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Adams SPF filters are ideal for community pools like that illustrated above. This triple SPF 169 can handle pools up to 730,000 gallons capacity.

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fair in allotting assessments to the several societies. A committee headed by Pecos Calahan, of California, presented a report recommending a formula that took into consideration not only the number of members of each association in the Council but also the size of the firms represented by those members. The formula was adopted for the assessment of dues with an amendment providing that during the 1957-58 fiscal year, no one association should be assessed an amount greater than one-fifth of the total Council budget. The tentative budget for the year was set at about $18,000. This is not as high as many of the directors would have liked, but it represents a compromise between the amount needed to cover the proposed work of the Council and the amount it was felt the associations could provide without hamstringing their own local activities.

A model constitution written to guide state associations in the process of organization was approved by the Council. Use of this model by a new association assures its having a constitution that will meet the requirements of the National Constitution adopted last year by the Council. This model constitution provides for only one class of membership in an association, all members being partners, principals, or officers of firms.

Also adopted was a Code of Ethics as prepared by the Ethical Practice Committee under the chairmanship of George Poulsen, of the Intermountain Association of Consulting Engineers. This Code will be published and distributed to all members of affiliated associations.

The Council took note of the apparent trend toward appointment of laymen as members of state registration boards, not only engineering registration boards, but also medical, legal, dental, and other professional boards of registration. The Council deplored this trend and now plans to contact associations in other professions to request their assistance in encouraging the appointment of professional men to registration boards.

The Council agreed that it is not only willing but anxious to cooperate with other engineering organizations on all matters that can best be handled by group action. With this in mind, the Council decided to apply for affiliate membership in the Engineers Joint Council.

A committee was appointed to study the current shortage of engineers as it affects the engineer in private practice. This committee was requested to avoid going over the same ground already covered by others but to investigate the particular problems of engineers in private practice and to work with others for an over-all solution.

Public relations, it was agreed, is a vital part of the Council's program. A positive program will be drawn up to get across to important segments of the public the story of the jobs done by consulting engineers. A program also will be started to have members of each association check professional and trade magazines for advertisements that offer "free engineering" or other services that are obnoxious to consulting engineers. These advertisements will be sent to a committee that will then write the ad-

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Reco Representative—W. B. Parson Co., Needham, Mass.

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vertisers and explain the position of the Council with regard to such offers. On the other hand, all ads that seem particularly good from the engineer's point of view also will be collected and notes of appreciation sent to the advertiser and his agency.

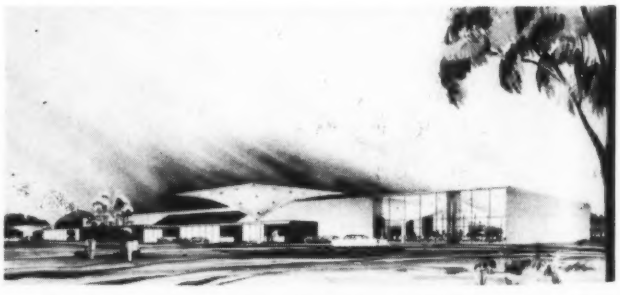
A report from Harry Terry, of New York City, stated that the Council now has a committee working with the Producers' Council in an effort to prepare an index for manufacturers' bulletins. The architects have such an index, and engineers need one to assist them in filing important catalogs and bulletins.

Before adjourning, the Board of Directors voted to hold the Annual Meeting of the Council in Minnesota, as guests of the Minnesota Association of Consulting Engineers, on May 3-4.

Industrial District Engineered From the Ground Up

The Dallas-Ft. Worth area of Texas, the State that does everything on a large scale, is the site of the nation's largest planned industrial district. The Great Southwest Corp., a privately financed company, has engaged well known engineers and architects to design a 5000 acre industrial community, incorporating a one million sq ft warehouse with belt connected truck terminal; plans for more attractive industrial plants that are less costly to construct; complete utilities; parking and loading facilities; and recreational and community facilities.

Now under construction is the district's first building, the Club Southwest, a public restaurant that includes a private dining room, conference rooms, a



CLUB SOUTHWEST FEATURES THIN SHELL ROOF.

display gallery, swimming pool, patios, and private club facilities. The building, designed by the Board of Associated Architects and Planners, made up of Felix Candela, Richard Colley, S. B. Zisman, O'Neil Ford, and A. B. Swank, Jr., is of hyperbolic paraboloid construction (see May '55 CE, "Thin Shell Roofs for Large Buildings," by Felix Candela). GSC, as part of its research program on construction of more economical industrial buildings, has developed a new forming system for these concrete shell umbrella structures.

Powell & Powell, Dallas, are consulting engineers on the over-all Development; E. H. Pierson, of North Texas Traffic Bureau, Dallas, is railroads consultant; W. H. Nichols & Co., Inc., Dallas, and Neil Drake, of

HOW TO USE HALLOWELL STORAGE WALLS IN MAKING ECONOMICAL STORAGE SPACE

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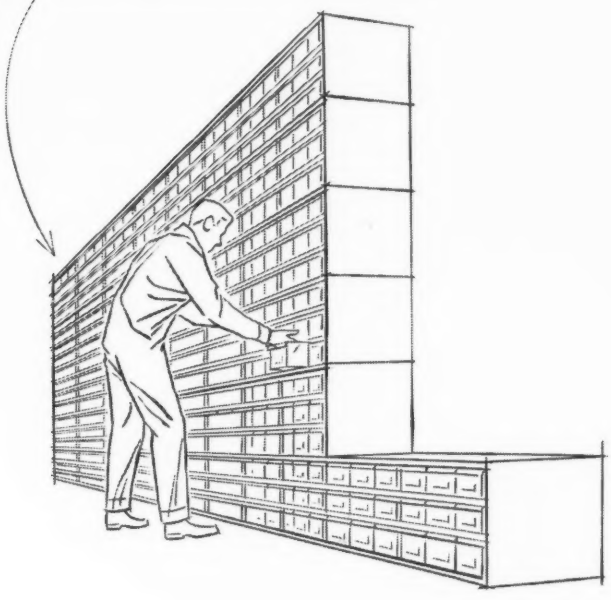
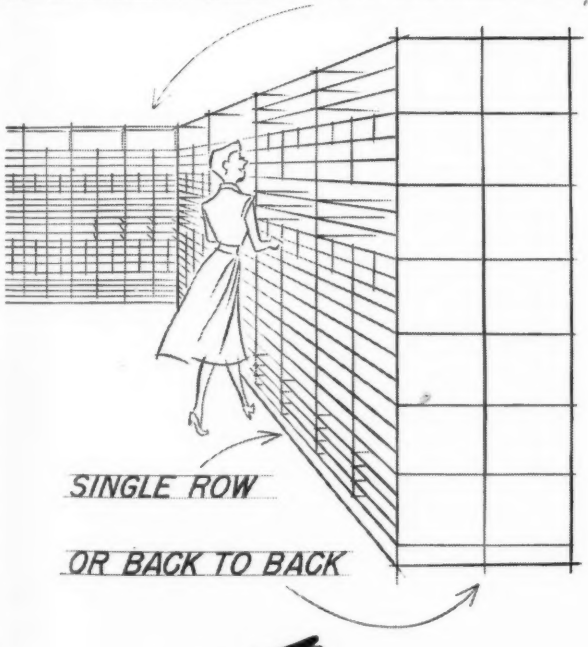


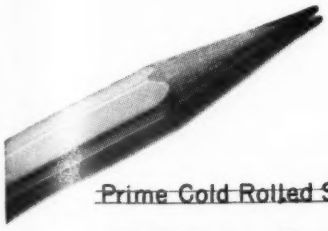
USE THEM TO BUILD PARTITIONS OR WALLS



SINGLE ROW

OR BACK TO BACK

SET THEM UP ADJACENT TO MACHINES AND OTHER WORK AREAS TO STORE BOOKS, TOOLS, PARTS, ETC.



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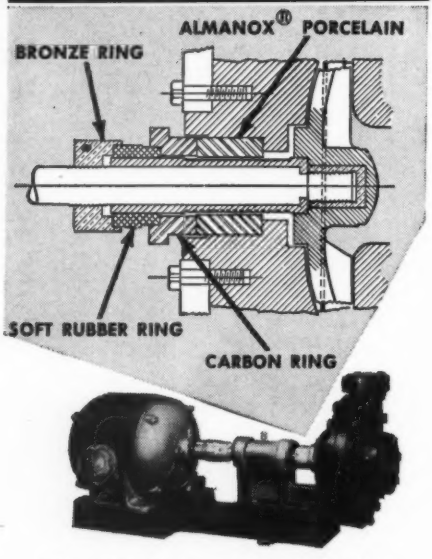

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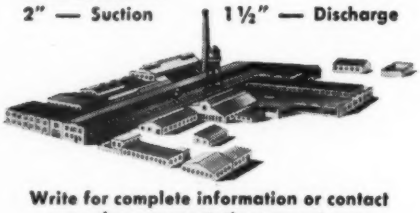

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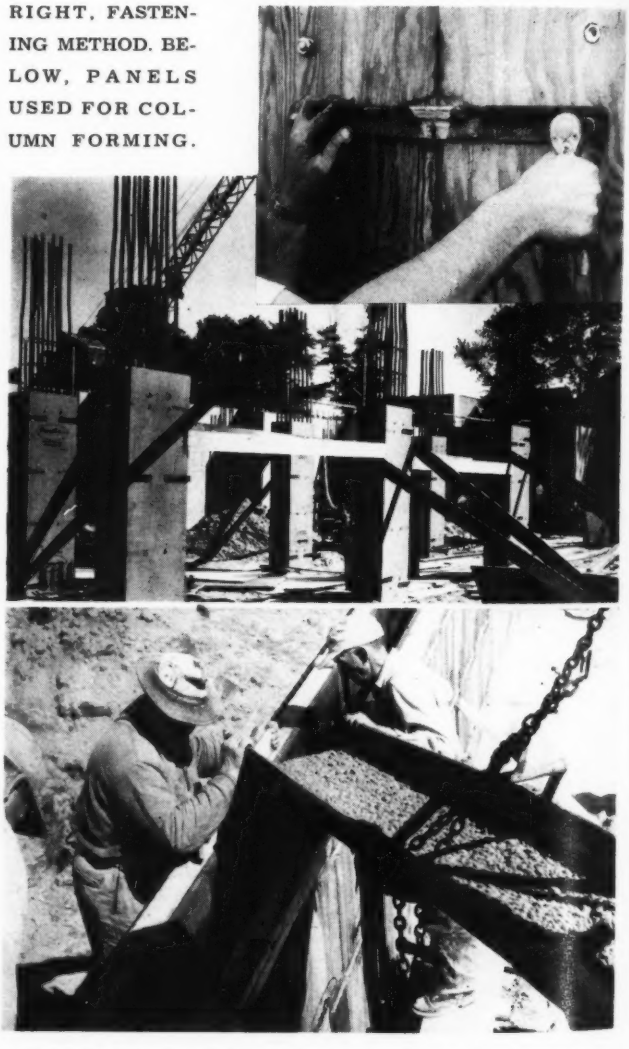
Drake, Startzman, Sheahan & Barclay, New York City, are distribution and materials handling consultants; and Lloyd Braff, Los Angeles, is traffic consultant on the project.

Studs and Walers Eliminated With Use of Plywood Forms

A 50 to 60 percent reduction in labor costs has been recorded with use of a concrete form method that utilizes 1⅛-in. exterior fir plywood panels pre-drilled and pre-fitted with rust resistant fastener hardware. The method, which eliminates studs and walers, is applicable for industrial and commercial forming, as well as for bridges, reservoirs and culverts.

RIGHT, FASTENING METHOD. BELOW, PANELS USED FOR COLUMN FORMING.



POURED CONCRETE MAKES FORMS SELF-ALIGNING.

Panels are fitted with anchor nuts and edge routed for form tie insert. The anchor nut is counter-bored into the plywood, so that no hardware protrudes before the panels are assembled. Steel clamps, used in place of walers, hold the panels together. They are attached quickly to the plywood at the job site by means of a cap bolt that screws into the anchor nut.

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INDUSTRIAL WATER SOFTENERS

FAMOUS-BARR BUILDING A in Northland Shopping Center, at Jennings, near St. Louis, Mo.
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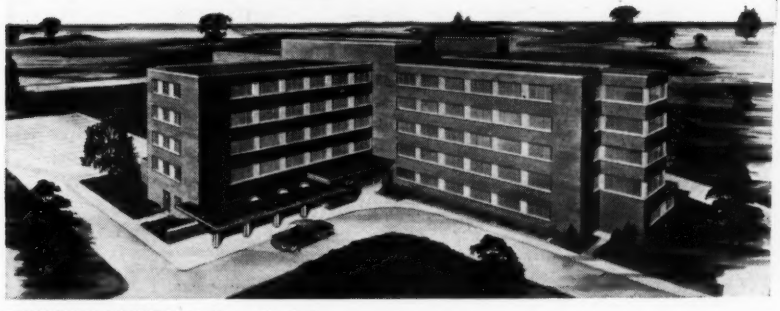

COMMUNITY HOSPITAL, Indianapolis, Ind.
Engineer: J. M. Rotz Engineering Co., Indianapolis, Ind.
Architect: Daggett, Naegele, Daggett, Inc., Indianapolis, Ind.
Plumbing Jobber: Crane Co., Indianapolis, Ind.
Plumbing Contractor: Freyn Bros., Indianapolis, Ind.

PANTEX ORDNANCE PLANT, St. Francis, Tex.
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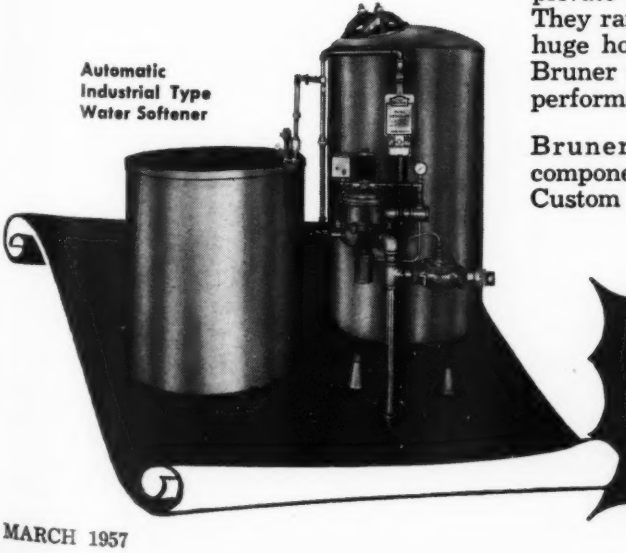
Bruner Industrial Water Softeners are meeting the needs of these important installations and in many other public and private buildings in all 48 states and seven foreign countries. They range from small laundries, schools, motels and resorts to huge hospitals, hotels, factories and atomic energy plants. Bruner is proud of its customer service — famous for product performance.

Bruner softeners, filters and other water conditioning components are available from stock in many types and sizes. Custom installations are fabricated to exact specifications.



Automatic
Industrial Type
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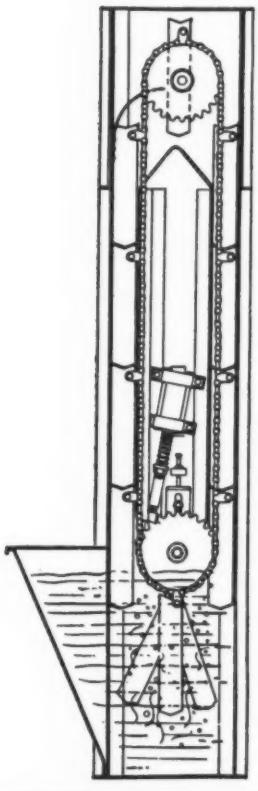
NEW AIR FILTER CLEANS ITSELF



"pulse-type" action keeps Automaze clean as new

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New Automaze goes 3 to 6 months without attention—a big improvement over stationary filters that may need cleaning once a month. Even after 6 months, all you need do is remove the sludge. A special reservoir cover makes this a quick, simple operation.

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Inner and outer walls may be constructed separately or simultaneously. As the concrete sets up, bottom panels may be detached and used to build the wall to the desired height. Panels also may be removed at any height for easier pouring access or for inspection during construction.

The process is especially suitable for stepped-up footings, pilasters, columns, and beams. Panels and steel clamps may be used either horizontally or vertically. Clamps are provided with a grooved slot for holding ties, which have a safe load of 5000 psi. Clamps and ties can be located so that fluid pressure of the poured concrete makes the forms self aligning and rigid without use of walers or studs.

This type of construction is being used on the South Bend Memorial Hospital, South Bend, Ind., although for this job the plywood and hardware were purchased separately and fabricated on the site.

The pre-fitted panels and hardware are products of FormCo., Inc., of Rockford, Ill.

Activities in State CE Associations

Reports from state consulting engineers associations indicate that there is increased interest on the part of engineers in private practice to work for and support such groups.

The Consulting Engineers Association of Washington has adopted a constitution and by-laws and elected officers to serve until July 1957, at which time the annual meeting and election of officers will be held. Present officers are: W. O. Stevens, W. O. Stevens & Co., chairman of the board; C. M. Barr, Marshall Barr & Associates, secretary; William Enkeboll, Dames & Moore, treasurer; and directors Lloyd F. Christofferson, Bouillon & Griffith; Allen E. Hill, Hill & Ingman; H. W. Kramer, Carey & Kramer; and Horace J. Whitacre, Horace J. Whitacre & Associates.

At the February meeting of the North Dakota Association of Consulting Engineers four areas were listed in which the group has made definite progress since its founding last June:

¶ Free engineering by certain manufacturers has been curtailed.

¶ A realistic and workable fee schedule has been drawn up for ratification.

¶ Professional conduct and tone of engineers and engineering have improved for engineer and public.

¶ Participation in civic and municipal affairs is being accelerated with positive results in public relations.

The Consulting Engineers Association of Oregon feel that improved public relations are so important that they have engaged a public relations counsel. The counsel presented a preliminary report at the January meeting and is preparing a program to be followed by the Association for discussion in March. The Association ratified its by-laws and voted to join Consulting Engineers Council at the meeting. Program included a panel discussion during which engineers in various fields of engineering explained the scope of each field and its individual problems.

At the annual meeting of the Consulting Engineers

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For new beauty in all-steel construction

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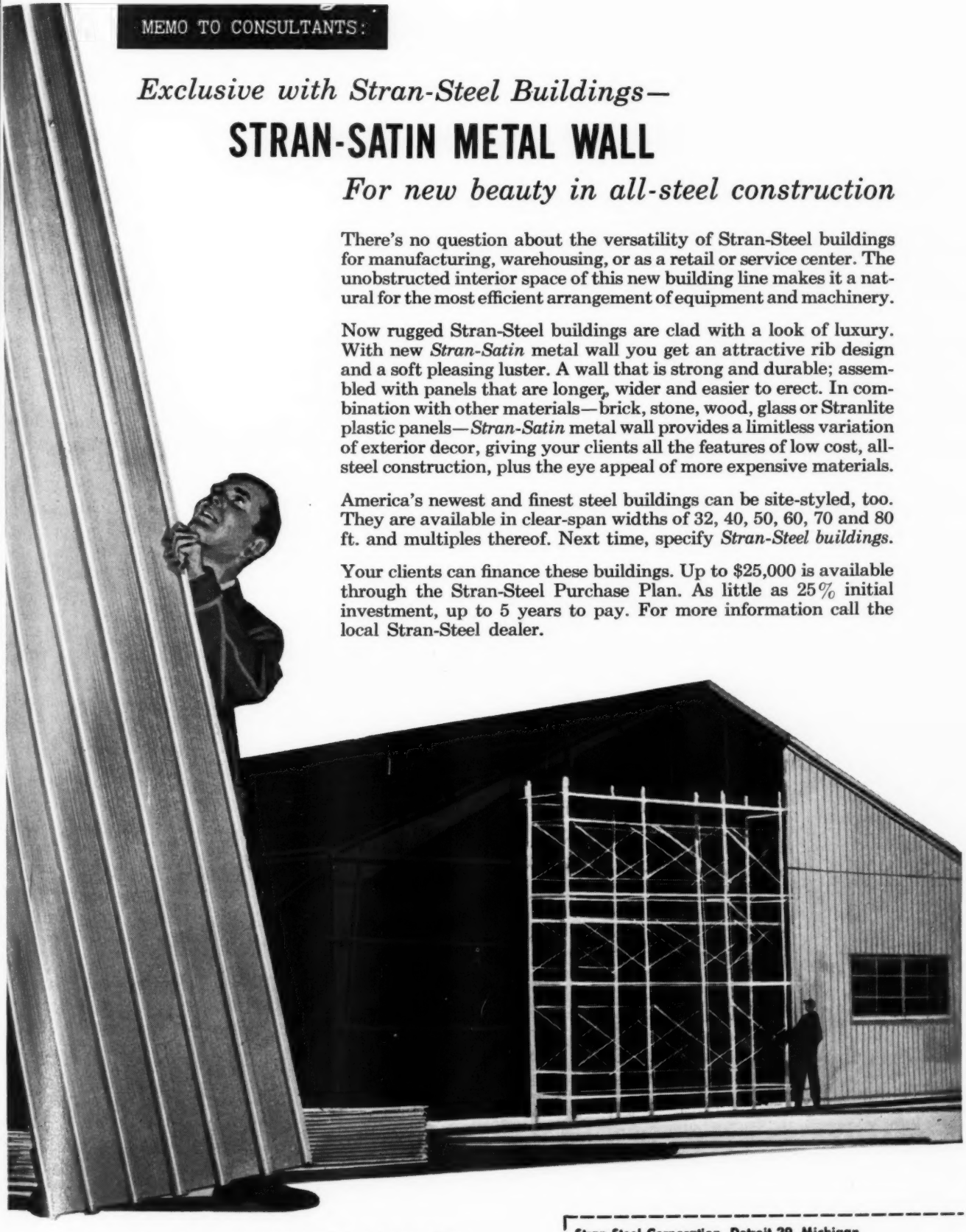
Now rugged Stran-Steel buildings are clad with a look of luxury. With new *Stran-Satin* metal wall you get an attractive rib design and a soft pleasing luster. A wall that is strong and durable; assembled with panels that are longer, wider and easier to erect. In combination with other materials—brick, stone, wood, glass or Stranlite plastic panels—*Stran-Satin* metal wall provides a limitless variation of exterior decor, giving your clients all the features of low cost, all-steel construction, plus the eye appeal of more expensive materials.

America's newest and finest steel buildings can be site-styled, too. They are available in clear-span widths of 32, 40, 50, 60, 70 and 80 ft. and multiples thereof. Next time, specify *Stran-Steel buildings.*

Your clients can finance these buildings. Up to $25,000 is available through the Stran-Steel Purchase Plan. As little as 25% initial investment, up to 5 years to pay. For more information call the local Stran-Steel dealer.



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Minneapolis 4, Minn., 708 S. 10th St.
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Looking for a *rugged* conveyor to cut your costs in handling heavy materials and parts—or parts to and from heat treating operations? *Pan-Link may be your answer!* Amazingly simple design eliminates ordinary chains—withstands grueling service. Many advantages.

INVESTIGATE! WRITE FOR NEW PAN-LINK BULLETIN CE-37

Hapman CONVEYORS, INC.
DIVISION HAPMAN-DUTTON COMPANY
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Right in the heart of the Golden Triangle—Hotel Pittsburgher

400 outside rooms with bath. Large-screen television and radio at no extra charge in every room. Air conditioning. Finest dining room. *ATlantic 1-6970*

Hotel Pittsburgher MOTEL

Opposite Greater Pittsburgh Airport on Airport Parkway west. 56 air-conditioned rooms with large-screen television at no extra charge. Tile bath. Private phone. Restaurant facilities. Courtesy car to and from airport. *AMherst 4-5152*

a Knott Hotel

JOSEPH P. DUDDY, GEN. MGR.

Association of California, Ralph M. Wescott, Los Angeles, was re-elected president; Mark Falk, San Francisco, vice president; Edward Lowe, Fresno, secretary-treasurer; and Pecos H. Calahan was reappointed executive secretary.

In the President's Annual Report, Wescott pointed out that CEAC has prepared a brochure to explain to the public, industry, and the Government the functions of the consulting engineer. It is expected to be a forerunner of other similar publications on such subjects as fees and negotiations with engineers, covering the question of competitive bidding.

His report also summarized activities to date on the problem of competitive bidding, stating that numerous instances of procurement practices which call for outright price bidding, as well as many instances which imply this situation, were brought to the attention of the Association in 1956. In a great majority of the cases the group was successful in altering the approach taken by the procurement people to the use of negotiation as a basis for award of contracts. Results with the Federal Government were not so successful, and the Association feels that only through the unified voice provided by the Consulting Engineers Council will the Government be brought around to the consultant's point of view.

In recommending that a committee be appointed to prepare a manual of practice relative to competitive bidding, Westcott said —

"The problem is somewhat complicated by the fact that our membership is not fully aware or in complete agreement as to just what constitutes competitive bidding or how to handle each individual problem as it arises. There are many requests for proposals issued which imply that price will not be a prime consideration in the award, but nevertheless request that prices be submitted. These may be defined as the gray cases and unless we have a clear agreement within our own membership that the submittal of prices which can be used as a comparative basis for selection is avoided, we are going to find that we are actually in a price competitive situation."

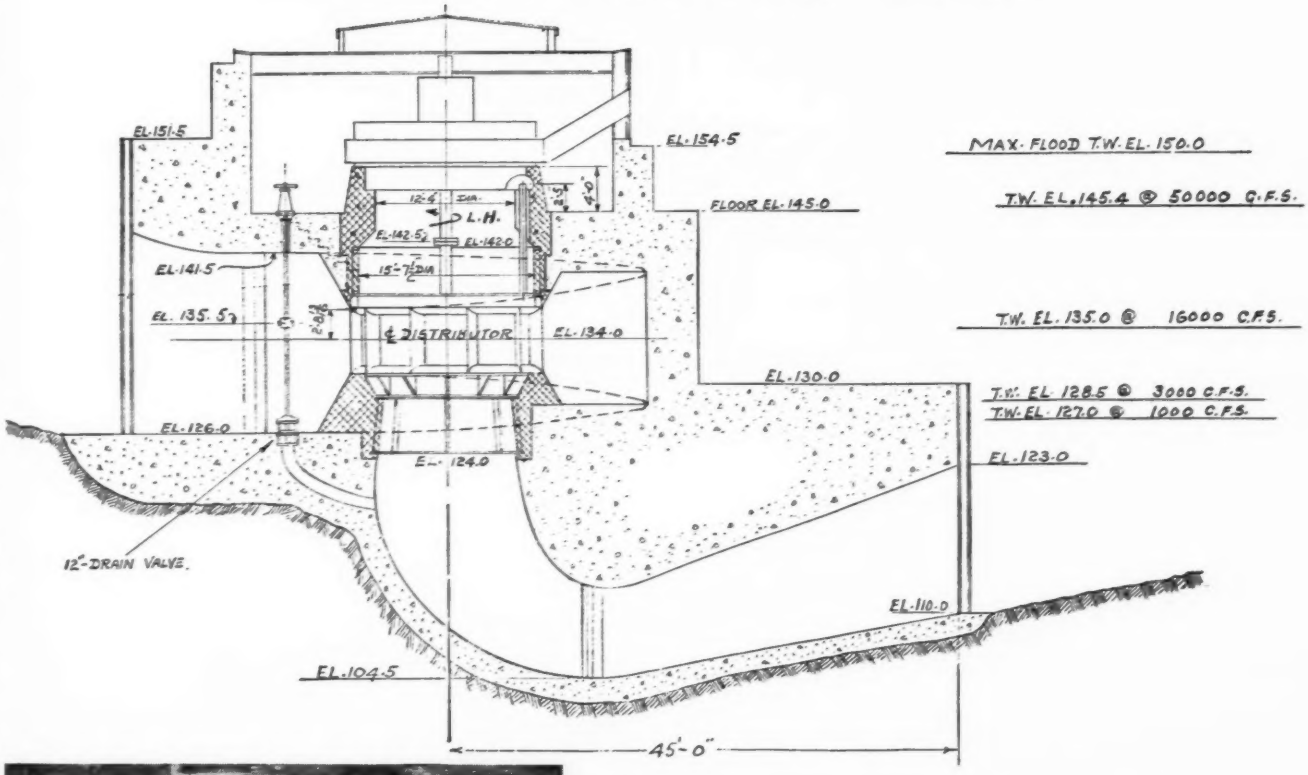
Compressed Air Opens Frozen Shipping Channels

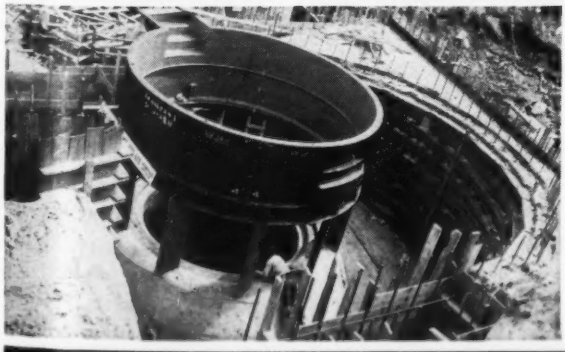
A system that may find use in keeping open the St. Lawrence Seaway and other strategic inland waterways during the winter is being tested at the Slave Falls Dam, part of the hydroelectric system for Winnepeg, Canada. An Atlas Copco Model AA 32 air compressor is being used to pump air through a 1½-in. pipe running across the 1200-ft dam about 14 ft below the surface. Air bubbles released from the pipe at approximately 50-ft intervals rise, bringing with them warmer water from the pool bottom. This water melts the surface ice. At one time a string of carbon arc elements had been used to keep the Falls ice-free, but high costs and difficulties encountered in operation limited the system's value.

Effectiveness of compressed air for keeping open shipping channels has been demonstrated on several

at the Central Maine Power Company's Bar Mills Station

Two Leffel Turbines Help Boost Power Output By 150%





An increase in annual output from 8,500,000 KW hours to 21,000,000 KW hours is expected by the Central Maine Power Company as a result of the recently completed rebuilding of their Bar Mills Hydroelectric Station. Two Leffel turbines—replacing four smaller turbines installed in 1919—play a major role in the Bar Mills redevelopment.

Each of the turbines is rated to develop 3,000 HP at 120 RPM under a twenty foot net effective head. The turbines, of the fixed-blade propeller type, are installed in concrete spiral casings and mounted on curved concrete elbow draft tubes.

The top view at the left shows the completed power plant and dam; the bottom view shows the installation of the turbine stay ring and pit liner in the concrete spiral casing.

Here and throughout the world, Leffel turbines are economically and efficiently harnessing water power. Before you plan any future turbine installation, get the facts on efficient, reliable Leffel turbines tailored to meet all your hydroelectric power requirements. Write today for complete information.

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If you have a friend — or know someone in your own organization — qualified to receive CONSULTING ENGINEER *free* — but not now receiving it, send us his name.

QUALIFICATIONS ARE:

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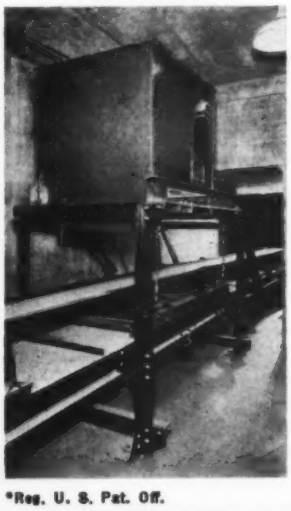

World renowned continuous automatic conveyor scale. Automatically weighs and totalizes the flow of material passing over a belt conveyor. Adaptable to an existing conveyor — easy to install—simple to maintain —suitable for control of auxiliary equipment — high weighing accuracy.

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Bulletin 375 on request

MERRICK SCALE MFG. CO.

PASSAIC NEW JERSEY

projects in Sweden. The 2940-ft ferry route linking Adelso and Munso on Lake Malaren in central Sweden boasts a permanent compressed air system. Before its installation, ferry operators spent about $1000 annually sawing ice out of the boats' paths. Original cost of the air system was about $1600 and yearly operating costs are low. Ice along the edges of the channel, which is 32-ft wide, measures up to 20 inches in thickness at times, but with use of compressed air the channel path itself never freezes.

The system also is being used successfully on a 500-ft ferry channel at Ulvsundets in the Stockholm Archipelago and in a shipyard near Stockholm, as well as at the Kastets saw mill pond near Gavle in central Sweden. Work is under way on a compressed air system designed to keep open a 60-mile channel between Vasteras and Sodertalje on the Lake Malaren route to the Baltic Sea.

The first link in this route was established last winter when a test plant was placed in operation at Fullero, in Vasteras' outer port district. A plastic hose about 1000-ft long was run out from shore along the unfrozen bottom of the lake. The half of the hose stretching furthest from shore was perforated with tiny holes through which compressed air could escape to the surface. The first 325 ft of this portion of the hose was perforated at 33-ft intervals. The 165-ft length at the terminal end was perforated every 16 ft. Within two weeks after the Fullero pilot plant was placed in operation, a channel about 65-ft wide had been melted through ice two-feet thick.

Current plans call for establishment of seven other compressor stations along the 60-mile waterway at a total capital investment of approximately $385,000.

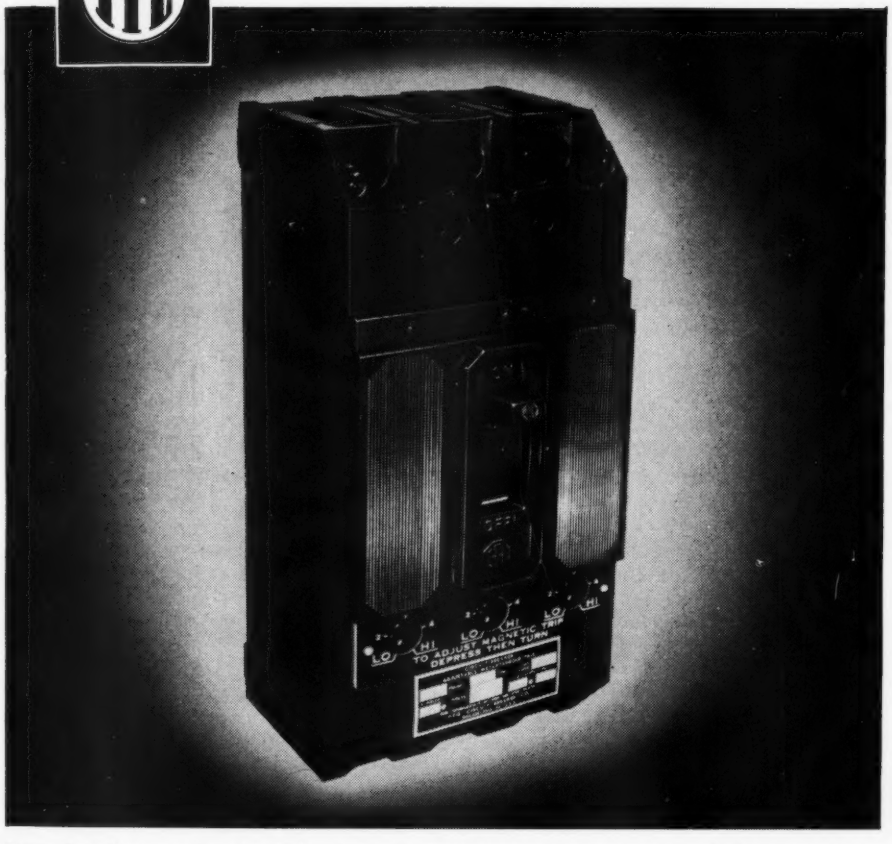
Kingston-Rhinecliff Bridge Opens to Traffic

The $19 million Hudson River Kingston-Rhinecliff Bridge, under construction since 1954, was officially opened in February. Its approach roads connect with Route 9G on the east and with Route 32 on the west.

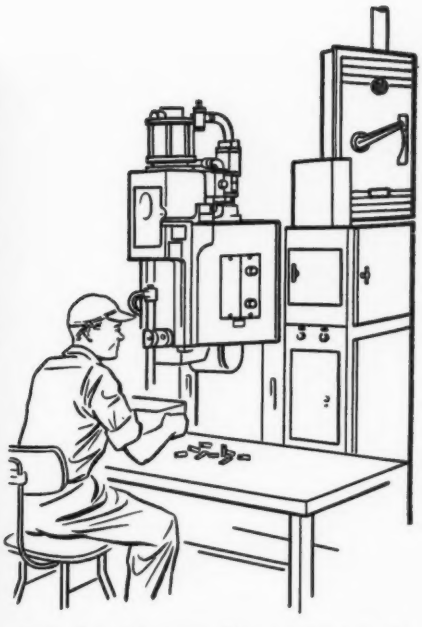
The steel bridge, 1½ miles between abutments, has twin-deck continuous truss units of 500-800-500-ft spans centered over two navigable channels. These channel units are separated by a central continuous unit of 500-500-ft spans. Each channel unit is flanked on the shore side with one 300-ft single truss span plus approach girder spans. Truss spans are supported on eight reinforced concrete river piers varying in height from 129 to 194 ft above the water. The 36-ft roadway rises on a 5200-ft vertical curve to an elevation 253 ft above the water at midspan.

Dr. D. B. Steinman, Consulting Engineer, New York City, designed the bridge and approach roads, and supervised the construction, with W. E. Joyce as project engineer; R. M. Boynton, engineer for substructure; C. H. Gronquist, engineer for superstructure; and M. O. Elkow, resident engineer of construction. The bridge is owned and operated as a toll bridge by the New York State Bridge Authority.

MOLDED CASE CIRCUIT BREAKERS



Magnetic only type ETI circuit breakers are available in F, J, K, KL, L and M frames (3 to 800 amperes continuous ratings), 2 or 3 pole, 600 v a-c, 250 v d-c.



Typical resistance welder application of *magnetic only* type ETI circuit breakers in an individual enclosure.

Selective Short Circuit Protection for Motors and Resistance Welders

External instantaneous trip adjustment.

In motor control and resistance welding applications, adjustment of protective devices to a required setting is important. One of the many features of the ETI circuit breaker is its convenient externally adjustable magnetic trip device. When it is required to adjust the trip to a finer degree, adjustment is made from the front of the breaker without interrupting service or encountering live conductors. The range of instantaneous trip adjustment means greater protection for motors and resistance welders. When a short circuit occurs, all poles open simultaneously. And enclosed terminals protect personnel, yet permit easy cable connections. All these extra values in I-T-E Molded Case Circuit Breakers are yours at no extra cost. Send for complete information or contact your nearest I-T-E authorized distributor.

Typical motor control application of *magnetic only* type ETI circuit breakers.

Molded Case Circuit Breakers...added value at no extra cost

I-T-E CIRCUIT BREAKER COMPANY Small Air Circuit Breaker Division

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Men in Engineering

The American Institute of Consulting Engineers has elected Edward H. Anson, senior vice president and director of Gibbs & Hill, as president. Members of the governing council are: E. Sherman Chase, Metcalf & Eddy; Dean G. Edwards, Edwards, Kelcey and Beck; and Emil H. Praeger, Praeger & Kavanagh.

The new consulting engineering firm of O'Reilly, Livingston & Associates has been formed at Seattle, Wash., as an affiliate of the naval architecture firm of Philip F. Spaulding & Associates. Hugh P. O'Reilly heads the firm, with Hart Livingston as principal associate. Other members of the firm are Phil Spaulding and Larry Glosten, who continue as partners with Livingston in the naval architecture firm.

Nominee for president of the American Institute of Electrical Engineers for the 1957-58 year is Walter J. Barrett, of New Jersey Bell Telephone Co. L. F. Hickernell, Anaconda Wire & Cable Co., is treasurer nominee. Vice presidents nominated are Benjamin R. Teare, Jr., Carnegie Institute of Technology; Robert W. Oetinger, Duke Power Co.; Albert G. Johnson, Omaha Public Power District; Orien A. Gustafson, General Electric Co.; and Gordon F. Tracy, University of Toronto. On the slate as directors are Edwin W. Morris, Westinghouse Electric Co.; William Russell Clark, Leeds & Northrup & Co.; and J. C. Strasbourger, Cleveland Electric Illuminating Co.

Rader & Associates, Miami, Fla., have opened a new office in the city of Panama. To be headed by Chester L. Lucas, the office will serve clients in the Latin American countries and the Caribbean area, as well as the Canal Zone. Eddie Karl-Gustav Borjesson has been appointed by Rader as resident manager of the Asuncion, Paraguay, water supply, treatment, and distribution system project under construction.

Century Engineers, Inc., Burbank, Calif., announces appointment of George E. Carius as senior staff engineer. Carius previousy headed his own engineering firm in Milwaukee.

Three associates have been admitted to partnership in the firm of Rummel, Klepper & Kahl, Baltimore, Md.: August W. Noack, Jr., Emil Kordish, and Burton N. Cox, Jr.

At The Fluor Corporation, Ltd., Los Angeles, Calif., J. L. Tathwell, formerly chief project engineer, and F. G. Crawford, formerly manager of project coordination, have been promoted to the newly created position of Manager of Projects.

Frank Sparks has joined the consulting firm of C. L. Shultz, specialists in the field of instrumentation and automation consulting.

New officers of the New York Association of Consulting Engineers are: president, Peter J. Reidy, Purdy & Henderson Associates, Inc.; vice president, John O'Keefe, Levy & O'Keefe; vice president, Matthew Hiller; secretary, Samuel A. Bogen, Bogen & Alston; and treasurer, J. F. Hennessy, Jr., Syska & Hennessy, Inc.

Robert S. Quig has been appointed manager of the Rate Department of Ebasco Services, Inc. He will have supervision of consulting services the department renders to electric, gas, and other utilities. He succeeds L. R. Lefferson, who retired.

Lincoln Bouillon, senior partner of the Seattle, Wash., consulting firm

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OF MORE DEPENDABLE POWER and at less cost per pound of steam

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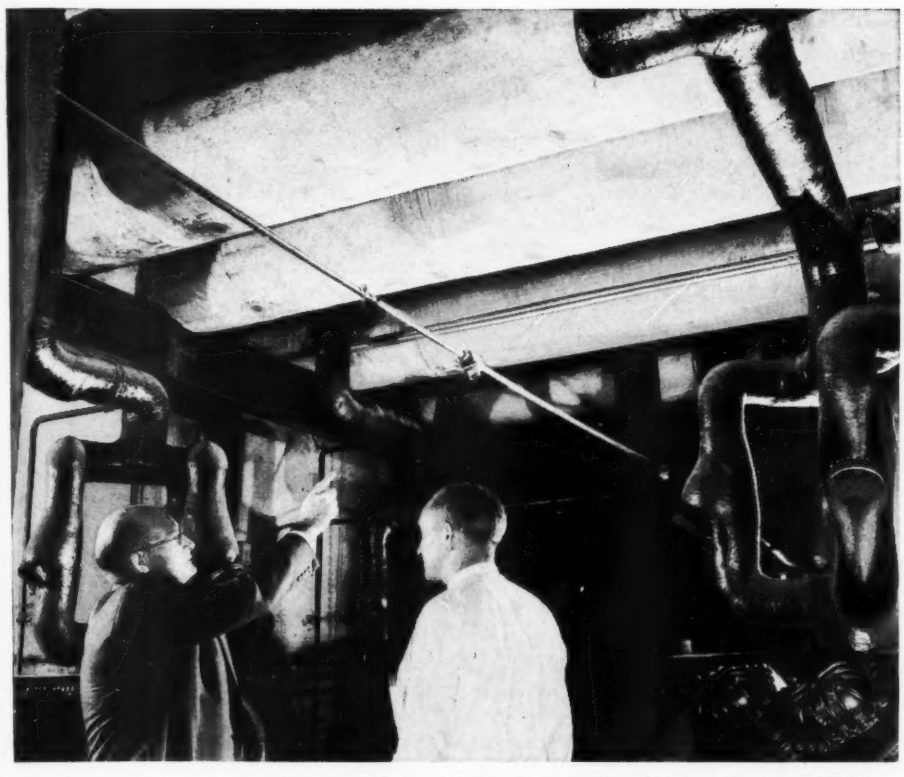
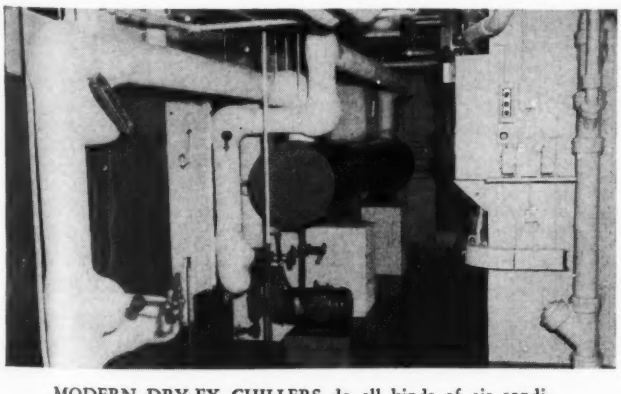


"They've never given us a bit of trouble," states Mr. R. E. Noll (left), Store Superintendent. With him is Mr. J. L. Quisenberry, Head of Maintenance for Wolf & Dessauer, who was with the store when the eight Dry-Ex units were installed in 1937. The system, including eight 50 hp condensing units and 15 remote air handling units, air conditions the main building's seven floors. The system was installed by Hipskind Heating and Plumbing Company of Ft. Wayne.

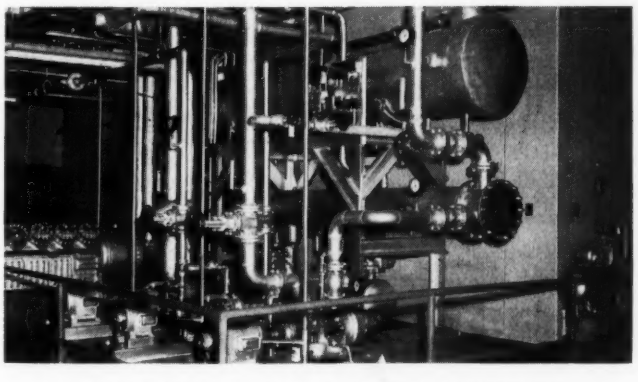
19 YEARS OF TROUBLE-FREE SERVICE

First *Acme* Dry-Ex® Chillers still in operation in famous Indiana department store

Operating with full capacity and efficiency since 1937, eight Acme Dry-Ex Chillers in the Wolf & Dessauer department store, Ft. Wayne, Indiana have never required any maintenance other than routine cleaning. As a result, in almost 20 years of operation, this busy store has never lost a day's air conditioning through interruption of service by these Acme units.



MODERN DRY-EX CHILLERS do all kinds of air conditioning, refrigeration and industrial, direct-cooling jobs. This Dry-Ex air conditions the Anderson Loan Association building at Anderson, Ind. The 50-ton system also utilizes an Acme evaporative condenser.



100-TON DRY-EX AND ACME FREON CONDENSER are major components of this Cincinnati, Ohio air conditioning installation in Western & Southern Life Insurance Company's modern office building. Two Acme Flow-Mizer® cooling towers allow constant re-use of condenser water.

The modern Dry-Ex combines the dependability of Acme's thru-tube construction, proven in 19 years of broad field experience, with the added efficiency of an exclusive star-insert tubing. You receive more chilling capacity per dollar of investment than ever before.

Acme custom builds Dry-Ex Chillers, utilizing standardized parts, to meet exactly the conditions of virtually any water chilling or other liquid cooling application. Capacities from 5 to 400 tons are available in single or multi-circuit units. Two model series, one with star-insert tubing and the other with plain tubing, are available. A wide range of baffle and head pass combinations make it possible to achieve ideal, controlled liquid velocities.

To Get Your Copy of Acme's data-packed Dry-Ex catalog, just send us this coupon attached to your letterhead

ACME AIR CONDITIONING REFRIGERATION

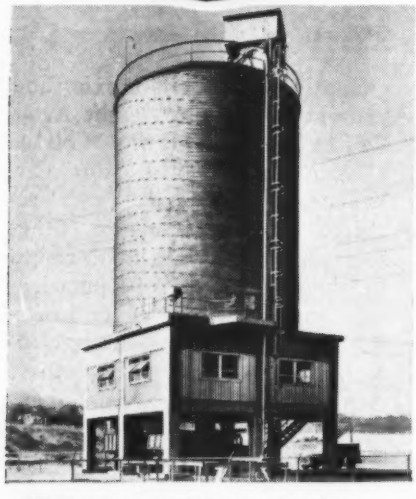
Acme INDUSTRIES INC., Jackson, Michigan

Dry-Ex Liquid Chillers · Liquid Receivers · Heat Exchangers · Condensers · Packaged Chillers · Packaged Heat Pumps · Evaporative Condensers & Cooling Towers · Room Conditioners

Manufacturers of Quality Air Conditioning and Refrigeration Equipment since 1919

The RIGHT Answer to Your BULK STORAGE Needs:

MARIETTA CONCRETE SILOS



Whatever materials you handle . . . powder form to 16" lumps . . . you can realize a big savings in time, labor and money with a MARIETTA storage system designed to your operation.

Marietta silos are economically erected in any desired capacity . . . any number of units. Interlocking concrete stave construction provides safe, dry storage . . . resists wind, shock or fire . . . requires a minimum of maintenance.

Conveyors, feeders, discharge systems or other auxiliary equipment for your particular material handling requirements can be mounted on the sturdy walls of a Marietta silo.

Depend on Marietta's 41 years of experience to design and erect the most efficient storage system for your need under one cost-saving contract. No delays due to critical material shortages with a Marietta installation . . . erection is quickly and efficiently handled by factory trained personnel.

Write for Marietta's Modern Industrial Storage Systems Booklet and the right answer to your bulk storage problems.

THE Marietta CONCRETE CORPORATION

41 Years Know-How in Pre-Cast Concrete Construction

Marietta, Ohio

BRANCH OFFICES: Baltimore 21, Md., Charlotte 6, N.C., Nashville, Tenn., Jamestown, N.Y.

of Bouillon and Griffith, is celebrating his 25th year as a consultant. The partnership was organized in 1946.

Malcolm T. McCants has opened consulting engineering offices in the Texas National Bank Building, Houston, Texas. The office will specialize in petroleum and petrochemical industry consulting. McCants was formerly plant manager for the Great Northern Oil Company, of St. Paul, Minn.

Burgwin & Martin, Consulting Engineers, Topeka, Kan., announce association with the firm as chief of the structural and bridge design section, Carlos D. Bullock, formerly regional structural engineer for the Portland Cement Association, in Kansas City.

G. C. McKinney, Civil Engineer, with principal offices in San Jose, Calif., has established an office for the general practice of civil engineering and surveying in the Fremont City Offices Building, Mission San Jose, Calif.

Whitman, Requardt and Associates, Baltimore, Md., announce that Raymond C. Regnier and Henry A. Naylor, Jr. have been made partners. Roland A. Clark, Charles F. Millard, Roger T. Powers, and Nevin S. Weiss have been appointed associate engineers.

R. S. Aries & Associates have moved their main office to new and larger quarters at 41 East 42nd St., New York.

Carl C. Crane, Inc., Consulting Engineer, Madison, Wis., announces retirement of Einar A. Nordstedt, vp and electrical engineer.

Klein & Saks, Washington, D. C., announces appointment of Richard L. Davies as executive director. He was formerly president of Pennsalt International Corp.

Dr. D. B. Steinman has named a three-man group to work with him on civil engineering development plans at Manhattan College in New York. The men are Walter G. Bain, vice president of Republic Aviation Corp.; Major General Hugh J. Casey, assistant to the chairman of the Board of Schenley Industries and formerly head of the New York City Transit Authority; and Emil H. Praeger, consulting engineer. The four-man committee is part of the 35-man Council on Engineering Affairs headed by Charles E. Wilson, former president of General Electric Co. Chief goal is establishment of a new engineering center on the Riverdale, N.Y., campus.

At the annual meeting of the Consulting Engineers Association of California, Ralph M. Westcott, Mechanical Engineer, Los Angeles, was re-elected president; Mark Falk, Structural Engineer, San Francisco, was re-elected vice president; Edward Lowe, Electrical Engineer, Fresno, was appointed secretary-treasurer; and Pecos H. Calahan, San Francisco, was re-appointed executive secretary.

Albert C. Wood Associates, Inc. announce election of K. O. Miller as vice president. Robert E. Derby continues as president.

Kaiser Engineers Division of Henry J. Kaiser Co. has appointed J. Frank Frain, of Oakland, Calif., principal engineer. For the past ten years, Frain has been a consulting engineer in Latin America.

James M. Fox, Consulting Structural Engineer, has moved into new offices at 8060 Telegraph Rd., Rivera, California.

William N. Pauley has been made a partner in the firm of H. E. Bovay, Jr., Consulting Engineers, Houston, Texas. Pauley has been in charge of the Spokane, Wash., office since it was opened in 1954, and will continue in that capacity with additional responsibilities as a partner.

D. E. Britt, Jr. and Maurice P. Beeman, of D. E. Britt Associates, Ft. Lauderdale, Fla., and Jerome E. Curley and Robert P. Jaffer, of J. E. Curley & Associates, Miami, have formed a new firm under the name of Britt-Curley Associates. Offices are at 3621B Henderson Blvd., Tampa.

Dr. C. G. Duncombe has become affiliated with The Hinchman Corporation as consulting engineer and member of the board of directors.

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HIGH PRESSURE GASKETS

All sizes to fit your gages

ERNST WATER COLUMN & GAGE CO.

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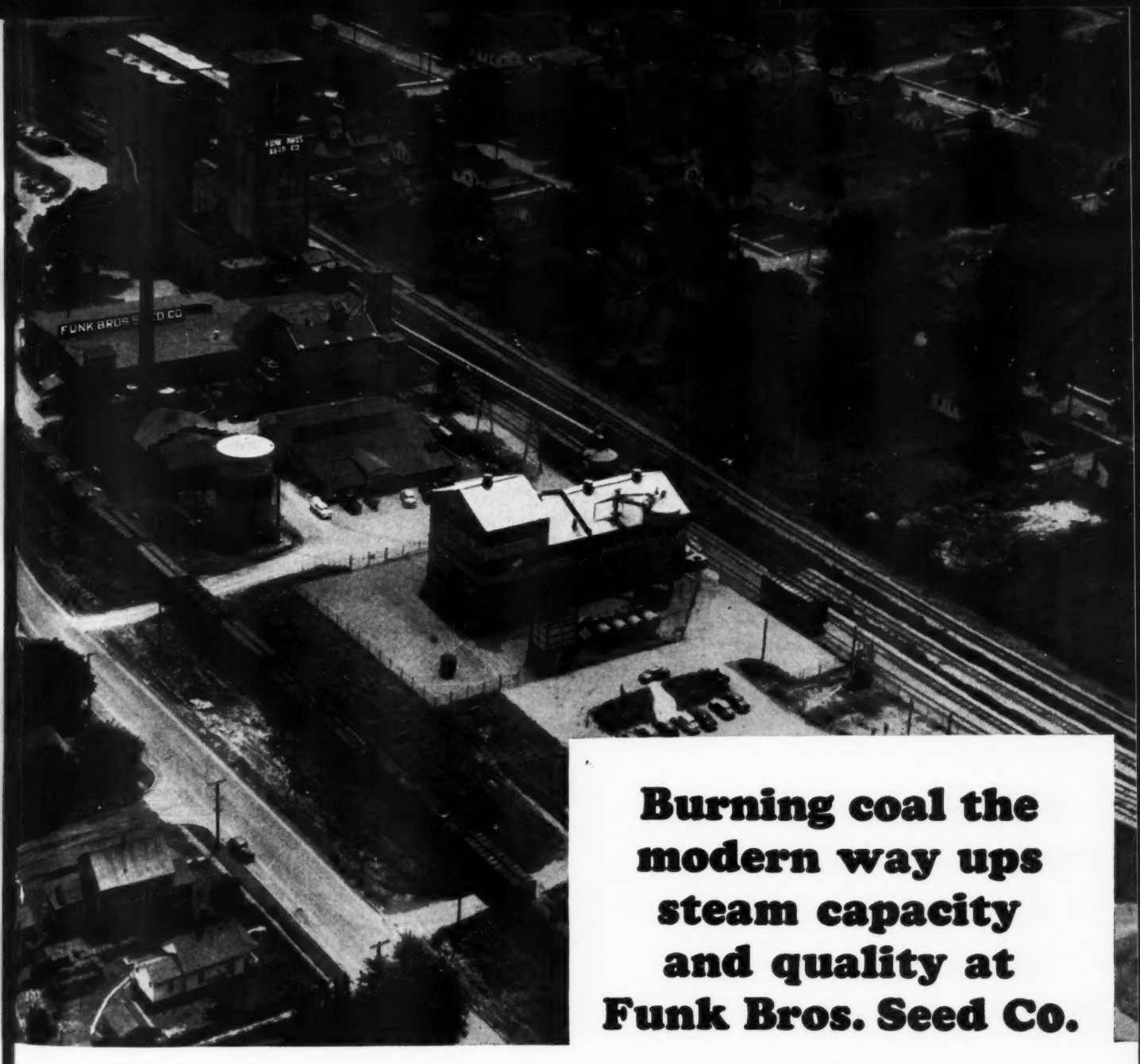


Burning coal the modern way ups steam capacity and quality at Funk Bros. Seed Co.

Note to consulting engineers:

Many companies planning a new power plant, or the remodeling of a present one, consult an engineering firm on its design and construction. When you have such a project, our Engineering Department will be glad to assist you in your fuel cost survey with any coal information you may require. In most cases, for the reasons listed below, the use of coal results in substantial savings in increased efficiency and fuel economy through the years.

facts you should know about coal

In most industrial areas, bituminous coal is the lowest-cost fuel available • Up-to-date coal burning equipment can give you 10% to 40% more steam per dollar • Automatic coal and ash handling systems can cut your labor cost to a minimum. Coal is the safest fuel to store and use • No smoke or dust problems when coal is burned with modern equipment • Between America's vast coal reserves and mechanized coal production methods, you can count on coal being plentiful and its price remaining stable.

As Funk Bros. Seed Co., Bloomington, Ill., increased the capacity of its soybean extraction plant 50%, the firm's old steam plant proved inadequate. Not only was it unable to produce enough steam, but steam quality was not suitable for best processing conditions. To remedy this situation, the company installed a new 26,000 lbs./hr. boiler, automatic controls, automatic coal and ash handling system and related equipment.

Today the steam plant at Funk Bros. requires only one man per shift, holding one of the most attractive operating jobs in the plant. Evaporation rates are in excess of 9 lbs. of steam per lb. of coal and there is adequate high quality steam for further expansion requirements. Also cleaner plant conditions resulting from this modernization have greatly improved community relations.

For further information or additional case histories showing how other plants have saved money burning coal, write to the address below.

BITUMINOUS COAL INSTITUTE
Southern Building • Washington 5, D. C.

New Projects Reported

By Consulting Engineers —

ALABAMA

Morris, Boehmig & Tindel, Inc., Atlanta, Ga.
Federal Reserve Bank, Birmingham, Ala., structural steel frame, welded connections. $1,700,000. Client, Toombs, Amisano & Wells, Arch., Atlanta, Ga.

John J. Harte Co., Atlanta, Ga.
Barge terminal and facilities, Florence. $500,000. Client, Alabama State Docks.

Day & Zimmermann, Inc., Philadelphia.
Aluminum reduction plant, Listerhill. $70,000,000. Client, Reynolds Metals Co.

CALIFORNIA

Golden, Bryant & Jehle, El Centro, Calif.
Sewage treatment plant (design population, 25,000). $600,000. Client, City of El Centro, Calif.

Sewage plant enlargement. $100,000. Client, City of Imperial, Calif.

241-unit Capehart housing project. $4,000,000. Client, Paderewski, Mitchell & Dean, Architects.

50-unit Federal housing project. $500,000. Client, Housing Authority of Calexico, Calif.

Ocean Street bridge. $82,000. Client, City of Santa Cruz.

Elementary school, Enterprise. Structural. Client, Gravlee & Kantz, Arch.

M. A. Nishkian & Co., Long Beach, Calif.
Central heating and refrigeration plant. Los Angeles Civic Center, Los Angeles, Calif. 160,000 lbs per hr, 275 psig steam, 4400 tons centrifugal refrigeration. $4,500,000. Client, County of Los Angeles.

Natural gas booster compressor plant. 20,000 bhp gas engine compressors. Needles, Calif. $4,500,000. Client, Southern Counties & Southern California Gas Co.

Davis & Ferguson, Van Nuys, Calif.
Bowling alley, Lancaster, Calif. 30,000 sq ft, 24 lanes, cocktail room, dining room, coffee shop, site improvements. Precast concrete, steel frame, heating and air conditioning. Brunswick equipment. $670,000. Client, Antelope Valley Recreational Center, Inc., Palmdale.

Hospital additions, Van Nuys, Calif. 28,000 sq ft, reinforced concrete, steel frame, brick masonry, surgical suite, delivery suite, obstetrical nursing section, surgical nursing section, storage, morgue, elevators, air conditioning. $600,000. Client, Valley Hospital Corporation, Van Nuys, Calif.

Bennett & Bennett, Pasadena, Calif.
Construction of Physical Sciences, Unit No. 2, for advanced studies in physics and chemistry and advanced research. $1,740,000. Client, University of California, Riverside.

CONNECTICUT

Fred S. Dubin Associates, Hartford, Conn.
S. J. Putnam office building, Wethersfield, Conn. Plumbing, heating, ventilating, air conditioning. $100,000. Client, George Dunkelburger, Arch.

General Electric Co., Newington, Conn. Ventilating, plumbing, heating, air conditioning. $500,000. Client, Anthony Pascone, Architect.

Barden Manufacturing Co., Danbury, Conn. Plumbing, heating, ventilating, process piping, air conditioning. $2,400,000. Client, Sherwood, Mills & Smith, Architects.

Niantic Baptist Church, Niantic, Conn. Plumbing, heating, ventilating, electrical. $100,000. Client, Painchaud & Ryder, Architects.

Acme Shear Co., Bridgeport, Conn. New building addition. Plumbing, heating, ventilating, electrical. $500,000. Complete power survey. $50,000. Client, Acme Shear Co.

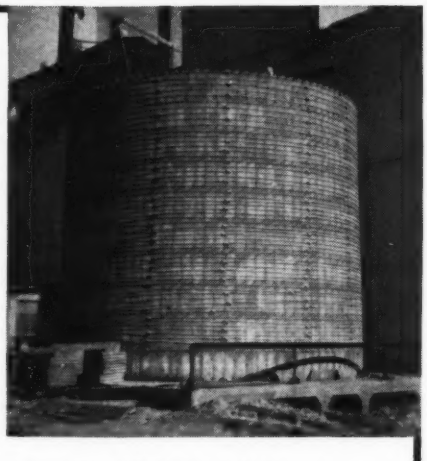
Hartford Provision Co. New electrical system. New Britain, Conn. $20,000. Client, Hartford Provision Co.

DISTRICT OF COLUMBIA

Andre Merle Associates, Washington.
Ramp garage and offices, Georgetown area. Modern garage, six stories, (three at this time), reinforced concrete construction. Structural engineers, **Otto Vogt, P.E.** $250,000. Client, Golden Commissary Corp.

General Engineering Associates, Washington, D. C.
Office building, Washington, D. C. 11-story office space and 3-story parking garage basement. Mechanical and electrical. $2,500,000. Client, Edwin Weihe, Architect.

Neff & Fry Bin Being Erected for Handling Silica Sand



When photographed, this Neff & Fry Super-Concrete Stave Bin was being erected for the Ottawa Silica Co., Ottawa, Ill. It is the first of two 28′ x 40′ bins which are now completed and in use. Silica sand is supplied principally to glass manufacturers, foundries, and concrete producers.

Through our experience in building thousands of bins, we have mastered the techniques of handling and storing virtually all kinds of flowable bulk materials. This knowledge is at your service upon request. You are invited to communicate with us.

To understand the special advantages of our unique type of construction, ask for our folder, "Bins with the Strength of Pillars."

NOT EXPORTED EXCEPT TO CANADA AND MEXICO.

THE NEFF & FRY CO. • 302 Elm St., Camden, Ohio

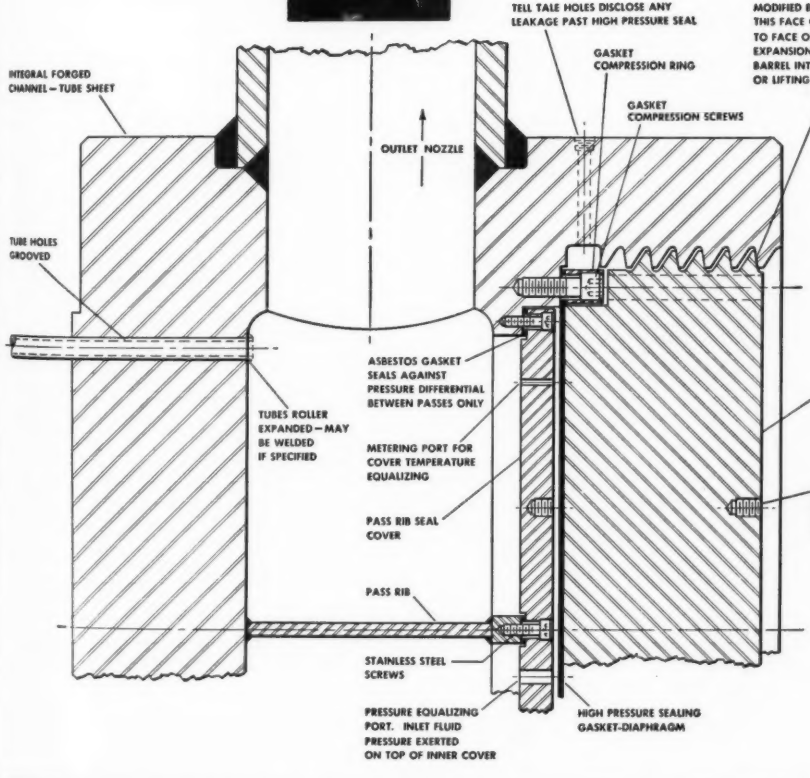
NEFF & FRY ➧ SUPER-CONCRETE STAVE STORAGE BINS

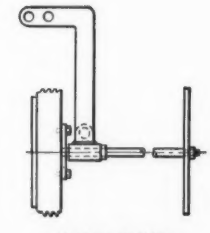
INSIDE FACTS

on the simplicity, safety and operating advantages of the exclusive Ross High Pressure Closure Design*

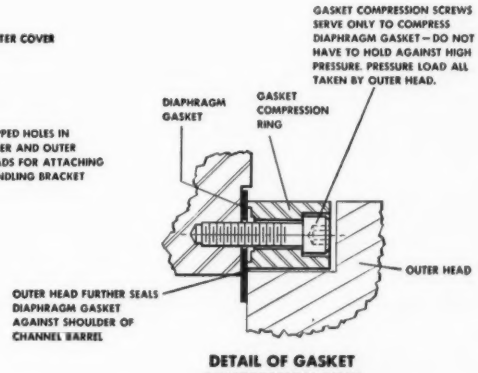
- Simpler design.
- Fewer parts to handle.
- High pressure seal unaffected by hydrostatic loads.
- Greater safety factor.
- Sudden load fluctuations no problem.
- Outer cover cannot corrode and bind . . . easily removed.
- Easily opened for inspection.

ROSS


TELL TALE HOLES DISCLOSE ANY LEAKAGE PAST HIGH PRESSURE SEAL
GASKET COMPRESSION RING
GASKET COMPRESSION SCREWS
MODIFIED BUTTRESS THREAD. THIS FACE OF THREAD PARALLEL TO FACE OF HEAD. DIFFERENTIAL EXPANSION BETWEEN HEAD AND BARREL INTRODUCES NO WEDGING OR LIFTING ACTION IN HEAD.
INTEGRAL FORGED CHANNEL – TUBE SHEET
OUTLET NOZZLE
TUBE HOLES GROOVED
TUBES ROLLER EXPANDED – MAY BE WELDED IF SPECIFIED
ASBESTOS GASKET SEALS AGAINST PRESSURE DIFFERENTIAL BETWEEN PASSES ONLY
METERING PORT FOR COVER TEMPERATURE EQUALIZING
PASS RIB SEAL COVER
PASS RIB
STAINLESS STEEL SCREWS
PRESSURE EQUALIZING PORT. INLET FLUID PRESSURE EXERTED ON TOP OF INNER COVER
HIGH PRESSURE SEALING GASKET-DIAPHRAGM
OUTER COVER
TAPPED HOLES IN INNER AND OUTER HEADS FOR ATTACHING HANDLING BRACKET



TYPICAL COVER HANDLING BRACKET FOR HORIZONTAL UNIT


GASKET COMPRESSION SCREWS SERVE ONLY TO COMPRESS DIAPHRAGM GASKET – DO NOT HAVE TO HOLD AGAINST HIGH PRESSURE. PRESSURE LOAD ALL TAKEN BY OUTER HEAD.
DIAPHRAGM GASKET
GASKET COMPRESSION RING
OUTER HEAD
OUTER HEAD FURTHER SEALS DIAPHRAGM GASKET AGAINST SHOULDER OF CHANNEL BARREL

DETAIL OF GASKET COMPRESSION RING FACING

NOW FOR ALL THE DETAILS, request new Bulletin 5.6K1, mailed immediately. Write Ross Heat Exchanger Division of American-Standard, Buffalo 5, N. Y. In Canada: American-Standard Products (Canada) Limited, Toronto 5, Ont.

ROSS HEAT EXCHANGER

Division of AMERICAN-Standard

*for feedwater heaters and other high pressure, high temperature exchangers

CONFIDENTIAL

PLANT LOCATION FACTS

on transportation costs

New York State has the most complete network of rail, water, highway and air routes in the world.

At your request we can determine the cost of assembling a given list of raw materials at any one or several locations within New York State. We will prepare cost and schedule data for the distribution of finished products from such locations to principal points of destination throughout the United States. The analysis can include movements by rail, water, highway or air or a combination of these forms of transportation.

Transportation won't be your only problem in deciding on a new plant location. You will want complete facts on labor, markets, water, available sites or buildings, power, fuel and raw materials. And you will want information on these as they apply to the successful operation of a specific plant.

A tailor-made report

Any or all of the factors important to your analysis will be covered in a confidential report to you—tailored to your needs. It will be prepared by a professional and experienced staff to cover either New York State locations of your choice, or, if you wish, sites which we will select on the basis of your needs.

Our booklet, "Industrial Location Services," explains what we can do for you. To get your free copy, write me at the New York State Department of Commerce, Room 585, 112 State Street, Albany 7, New York.

Edward T. Dickinson

EDWARD T. DICKINSON
COMMISSIONER OF COMMERCE

Office building, Washington, D. C. 12-story. Mechanical and electrical. $1,000,000. Client, Edwin Weihe, Architect.

FLORIDA

Parsons, Brinckerhoff, Hall & Macdonald, New York, N. Y.
Preliminary designs, specifications, and cost estimates for proposed construction of new moorings, finger piers and shore facilities for two city yacht basins. Client, Municipal Yacht Basins, St. Petersburg, Fla.

R. L. Kenan & Associates, Inc., Pensacola, Fla.
Sanitary sewer outfall including two lift stations. $500,000. Client, City of Pensacola, Fla.

Street paving. $450,000. Client, City of Ft. Walton Beach, Fla.

Water supply well, aerator, and reservoir. $150,000. Client, City of Ft. Walton Beach, Fla.

Sanitary sewage collection system. $265,000. Client, Santa Rosa Island Authority, Pensacola, Fla.

Sewage treatment plant. $300,000. Client, Apalachicola, Fla.

U. D. Gosselin, Ocala, Fla.
Water distribution system. (Preliminary studies in association with **J. R. Moorhead, Engineer,** Ocala.) Homosassa, Fla. $250,000. Client, Citrus County.

Preliminary work, theatre alteration, street widening, Ocala, Fla. $75,000. Client, R. H. Todd Co.

Preparation of specifications and bid documents for steel building to be purchased by City of Ocala, Fla. $70,000. Client, City of Ocala.

Russell Raine & Associates, Winter Park, Fla.
Remodeling of existing 10-story bank building and new 10-story addition. St. Petersburg, Fla. $1,500,000. (est.) Client, First Federal Savings & Loan Association, St. Petersburg, Fla.

Addition to Morton F. Plant Hospital, Clearwater, Fla. $1,100,000 (est.) Client, West Coast Hospital Association.

Power plant, Patrick Air Force Base, Cocoa, Fla. $800,000 (est.) Client, Corps of Engineers and James Gamble Rogers II, Architect.

Murray L. Eisenberg, No. Miami, Fla.
Enlarging motel with drive-in parking, new reception hall, and offices, TV room, card room. Miami Beach, Fla. $100,000.

Four stores, parking area. $53,000.

Wolpert-Tilden & Assoc., Orlando, Fla.
Hilton office building, Ocala, Fla. Electrical, plumbing, and structural. $250,000. Client, E. Bryan Duncan.

Office building, Cocoa Beach, Fla. Structural design. $125,000. Client, John Stetson Assoc.

Leesburg telephone building, Leesburg, Fla. Structural design only. $400,000. Client, Howell Hopson.

Briley, Wild and Associates, Daytona Beach, Fla.
New sewage treatment plant, 2½ mgd, sewage pumping stations, interceptor sewers, and lateral sewers. Palatka, Fla. $600,000. Client, City of Palatka.

Water supply and distribution sanitary sewer system and sewage treatment plant. Callahan, Fla. $450,000. Client, Town of Callahan.

Water supply and enlargement and rehabilitation of water treatment plant. Ormond Beach, Fla. $470,000. Client, City of Ormond Beach.

GEORGIA

John J. Harte Co., Atlanta, Ga.
Limited access expressway, Atlanta, Ga. $10,000,000. Client, City-State.

Railway slope protection, Buford Reservoir, Ga. $200,000. Client, Corps of Engineers.

Various housing projects throughout Georgia and Florida. $1,500,000. Client, Housing Authorities.

Schools and school buildings: Elbert County, Ga. ($1,000,000); Macon County ($640,000); DeKalb County, Ga. ($650,000); Meigs County, Tenn. ($100,000). Client, County.

Morris, Boehmig & Tindel, Inc., Atlanta, Ga.
Science Center, University of Georgia, Athens, Ga., consisting of 4 reinforced concrete buildings. $10,000,000. Client, Associated Architects, Atlanta, Ga.

J. Wylly Keck, Jr. & Associates, Atlanta, Ga.
Swimming pool, filter plant, and associated facilities. Atlanta, Ga. $250,000. Client, East Lake Country Club.

New steam plant and utilities. Scottdale, Ga. $65,000. Client, Scottdale Mills.

Fuel test facility modifications including emergency personnel protection and utilities. Marietta, Ga. $95,000. Client, Lockheed Aircraft Corp.

ILLINOIS

James G. Cooney & Associates, Carlyle, Ill.
150,000 gal elevated storage tank and reinforced concrete ground storage at the filtration plant. $75,000. Client, Freeburg, Ill.

Raw water supply line and appurtenances. $60,000. Client, Pinckneyville.

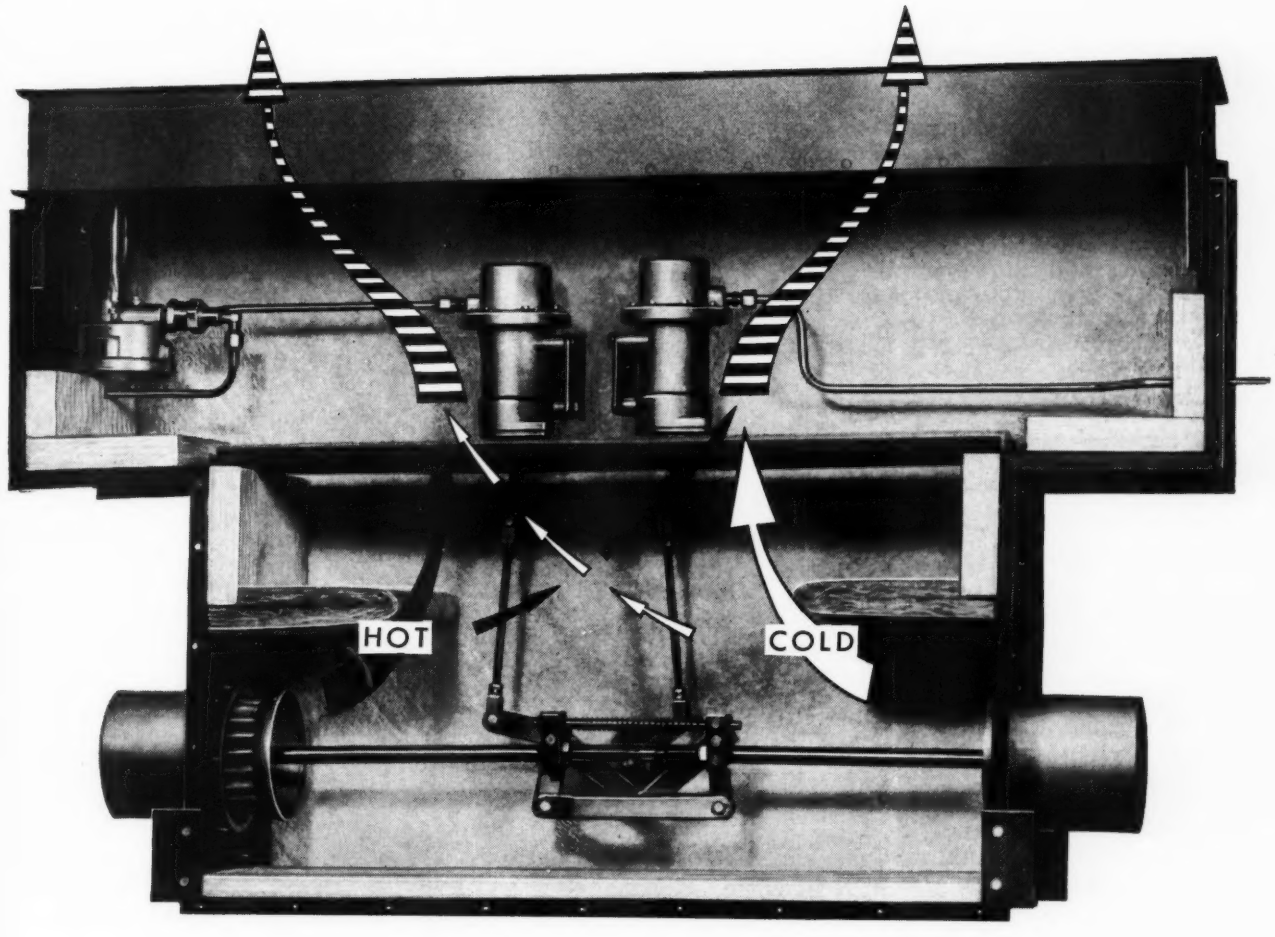
Wight and Company, Downers Grove.
Expressways, bridges, structures, and highways. DuPage County, Ill. $6,000,000. Client, State of Illinois, Division of Highways.

The Austin Co., Chicago, Ill.
Single-story, 1,520,000 sq ft manufacturing building with steel frame and

How **ANEMOSTAT**®

All-Air Constant Volume

High Velocity units operate



Here is a vitally important advance in the field of air distribution. Anemostat All-Air High Velocity units, *with new simple automatic controls,* deliver constant volume, no matter what the fluctuations from 1:4 or 4:1 on inlet pressures of either the hot or cold valve.

Each unit is a single package including the controls and integral thermostats, if required. There is complete accessibility of all controls through removable diffusers. No access panels are required. Capacities of CONSTANT VOLUME units can be pre-set at the factory.

These Anemostat CONSTANT VOLUME units

- Assure scientific draft-free distribution of air.
- Are available in 100% induction units.
- Include Anemostat die-cast metal rocket-socket valves. More than 50,000 of these valves are in service, and not a single one has needed maintenance.
- Operate on standard 15 lb positive acting compressed air systems.

Each unit contains a micropressure regulator in the box, sensitive to .02 static pressure. This in turn operates a pneumatic motor and independently maintains by adjustment constant volume, while the wall mounted or integral thermostat controls the outlet mixture temperatures.

Write on your business letterhead for your copy of

New Anemostat Selection Manual 60

to Anemostat Corporation of America, 10 East 39 Street, New York 16, N. Y.

ANEMOSTAT: The pioneer of All-Air Velocity Systems

HOW TO GET AROUND TIME and COST FACTORS

in Protecting Pipe Against Corrosion

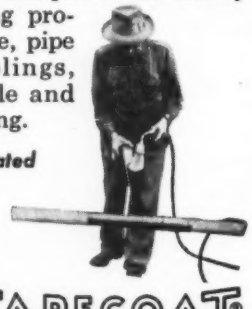
When you are faced with the problem of protecting piping underground in highly corrosive soils, a high quality coal tar coating such as called for in AWWA Specifications C-203 and C-204 is normally hot applied at a pipe coating mill. However, in many cases, the volume of pipe does not warrant this expense or the coating mill is too far away to justify the time involved.

That's WHEN Engineers Specify TAPECOAT® . . . the practical alternate hot-applied coal tar coating in handy tape form

Because TAPECOAT provides a coal tar coating equivalent in long-life protection to hot-applied coating at the mill, engineers are specifying this quality alternate material where time and cost factors preclude mill application.

This practical solution assures the protection required without the need for tar kettles, technical know-how and special crews. Field application costs are reduced because TAPECOAT is so easy to apply, using a torch to soften or bleed the pitch and then spirally wrapping it on the vulnerable surface.

TAPECOAT comes in handy rolls of 2″, 3″, 4″, 6″, 18″ and 24″ widths. Since 1941, it has proved its ability to give lasting protection to pipe, pipe joints, couplings, conduit, cable and insulated piping.



Write for illustrated brochure.

The TAPECOAT® *Company*

Originators of Coal Tar Coating in Tape Form

1569 Lyons Street
Evanston, Illinois

fireproof roof. Two-story portion will house offices and research and development laboratories. Client, Automatic Electric Co.

Giffels & Vallet, Inc. & L. Rossetti, Detroit, Mich.
Design proposed Industrial Engine Plant, general offices building, and extensive research facilities. Client, Caterpillar Tractor Co., Peoria, Ill.

Homer L. Chastain & Associates, Northbrook, Ill.
7.5 miles of Tri-State Route, Northern Illinois Toll Road, Section T-11. To include design and supervision. $7,500,000. Client, Illinois State Toll Highway Commission.

IOWA

Frank L. Pulley, Des Moines, Iowa.
Garton school, Des Moines. $1,400,000. Client, Wetherell & Harrison.

Martin Luther Home, Sioux City. $3,000,000. Client, Wm. Beuttler.

MICHIGAN

R. H. Gove, Kalamazoo, Mich.
50-lot subdivision, roads and drainage. Sugar Loaf Acres No. 1, Kalamazoo, Mich. $16,000. Client, L. S. Roberts.

46-lot subdivision, roads and drainage. Grosse Pointe Village, Kalamazoo. $12,500. Client, Langervelt & Troff.

The Fluor Corp., Ltd., Los Angeles, Calif.
Process design, engineering, and construction of 3500 bbl/day sulfuric acid-alkylation unit and feed preparation facilities at Trenton, Mich. $3,500,000. Client, Socony Mobil Oil Co., Inc.

McNamee, Porter & Seeley, Ann Arbor, Mich.
Drains, Macomb County, Michigan. $15,000,000.

Relief sewers, Adrian, Mich. $900,000.

Filtration plant, Cadillac. $1,500,000.

Sewage treatment, Cadillac. $600,000.

Water and sewage plant improvements, Howell, Mich. $700,000.

MINNESOTA

Lindsey, Carter & Associates, Inc., Excelsior, Minn.
Sewer extensions, sewage lift station, storm sewer, and sewage treatment plant revisions. $160,000. Client, Village of Annandale, Minn.

Sewage collection system and disposal plant. $75,000. Client, Village of Chanhassen, Minn.

Earl H. Ruble, Duluth, Minn.
Sewage treatment plant and interceptor sewer and storm sewers. $400,000. Client, Two Harbors, Minn.

Water supply, treatment, distribution. $300,000. Client, Two Harbors, Minn.

Sewage treatment plant. $25,000. Client, Iron Junction, Minn.

Sewage treatment plant, Cohasset, Minn. $20,000. Client, Minnesota Power & Light Co.

Jack D. Salo, Inc., Duluth, Minn.
2500 ft of street widening, concrete curb and gutter, grading, gravel base, and storm sewer in Cook, Minn. $35,000. Client, Village of Cook.

Surveys for high bridge between Duluth, Minn. and Superior, Wis. Client, Howard, Needles, Tammen & Bergendoff, Kansas City, Mo.

240-unit housing project. Site plan, grading, utilities, drainage, and paving at Duluth, Minn. Client, A. R. Melander, Architect, Duluth, Minn.

2000 ft of U.S. Highway #61, widening, concrete curb and gutter, bituminous paving, and storm sewer in Moose Lake, Minn. $26,000. Client, Minnesota Highway Dept.

MISSISSIPPI

John J. Harte Co., Atlanta, Ga.
U. S. Naval Auxiliary Air Station, Meridian. $30,000. Client, U. S. Navy.

MISSOURI

Russell & Axon, St. Louis, Mo.
Waterworks system including deep well, pumps, elevated storage, and water distribution system. $60,000. Client, City of Berger, Mo.

Street paving, concrete with integral curb, and drainage. $95,000. Client, City of Hayti.

Flood protection in City of Cape Girardeau, Mo., including pumping stations, floodwall, railroad closure structures. $4,000,000. Client, Corps of Engineers, St. Louis District.

Drazen and Associates, St. Louis, Mo.
Rural telephone project. Plans, specifications, and drawings. Client, Kingdom Telephone Co., Auxvasse.

Fred S. Dubin Associates, Hartford, Conn.
Elliott Chapel Unitarian Church, St. Louis, Mo. Plumbing, heating, ventilating, air conditioning, electrical. $400,000. Client, Murphy & Mackey, Arch.

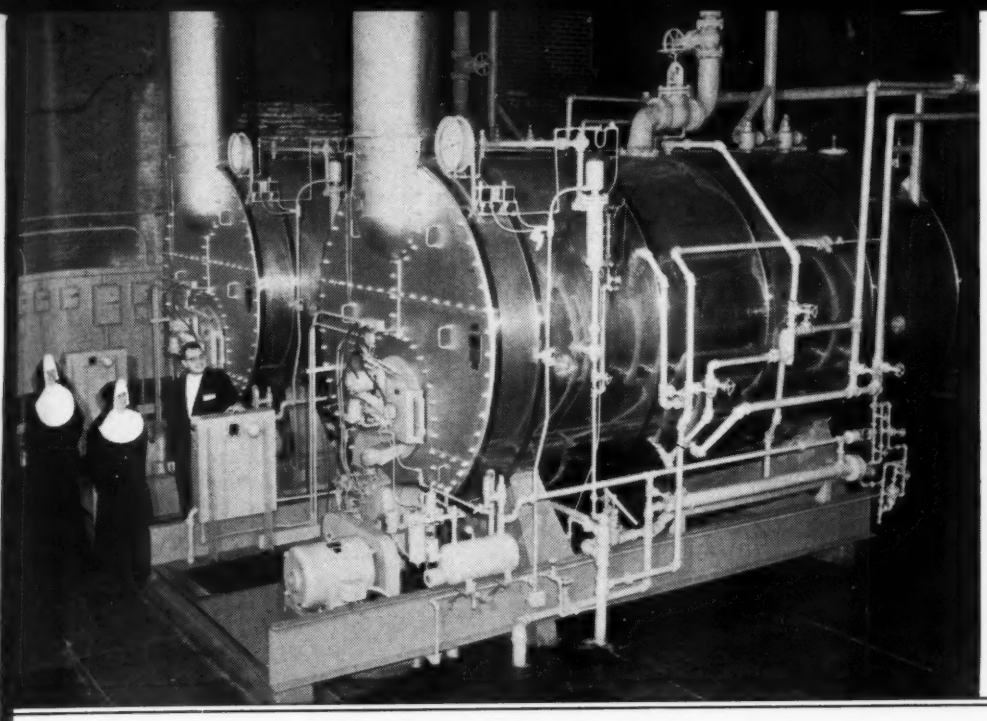
Williamson & Associates, St. Louis, Mo.
Two sewage lagoons for complete sewage treatment, St. Louis County. $35,000. Client, Principia College.

New municipal sanitary sewer system and sewage lagoon. $264,500. Client, City of Fornfelt, Mo.

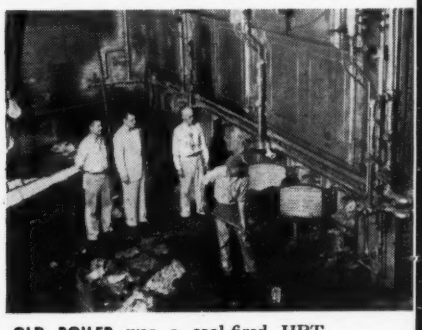
Sanitary sewer system for Gardenville Sewer District, St. Louis County. $275,000. Client, Metropolitan St. Louis Sewer District.

NEW JERSEY

Parsons, Brinckerhoff, Hall & Macdonald, New York, N. Y.
Preliminary engineering study of pro-



NEW BOILERS combine efficiency and handsome appearance. Edward S. Green, Edgemont (Pa.), contractor, was responsible for this superior installation. Pictured left to right are: Sister M. Cor Immaculatum, Immaculata College Treasurer, Sister Jean Marie, Community Treasurer, Reverend Mother Maria Alma, Superior General and Salvatore S. Guzzardi, Consulting Engineer.



OLD BOILER was a coal-fired HRT model — typical of many replaced by modern Cleaver-Brooks oil, gas or combination oil/gas fired boilers.

Consulting engineer* tells how Immaculata College boiler modernization saves estimated $12,000 each year

Salvatore S. Guzzardi CONSULTING ENGINEER

2928 LEWIS TOWER · PHILADELPHIA 2, PA · KINGSLEY 6-2777

December 20, 1956

Mr. John C. Cleaver, President
Cleaver-Brooks Company

Dear Mr. Cleaver:

Recently our office was retained to make an impartial, exhaustive engineering study of the 40-year old boiler plant and steam system at Immaculata College, Immaculata, Pa., which is staffed by the Catholic order, Sisters of the Immaculate Heart of Mary.

As a result of our recommendations, two fully automatic, oil-fired, 350 bhp Cleaver-Brooks package steam boilers, (12,000 lbs/hr steam each), replaced three hand-fired coal boilers and steam-driven auxiliaries. The new boilers are operating at approximately 80% boiler efficiency year-round.

Conversion of coal firing to automatic #6 oil firing and increased boiler efficiency has reduced the fuel cost approximately 50% -- amounting to a saving of $12,000 each year.

The Cleaver-Brooks boilers burn #6 oil and operate automatically at 80 pounds steam pressure 'round the clock -- without the presence of operators in the boiler room. Eliminating boiler plant labor saves the College $7,500 each year.

The cost of the boiler plant modernization will be paid for out of fuel and labor savings in approximately 2-1/2 years.

Commendation for this outstanding performance of the Immaculata boiler plant is due to your well-engineered boiler design and to the cooperation of your skilled servicemen. The results achieved were so impressive that the Sisters subsequently modernized their Villa Maria Convent, Westchester, Pa., with two 100-bhp Cleaver-Brooks boilers.

Sincerely yours,

Salvatore S Guzzardi

Salvatore S. Guzzardi — Award-winning head of an organization of experienced professional engineers specializing in modernizing power service facilities. Clients include: Pennsylvania University, Baldwin-Lima-Hamilton Corp., H. Daroff & Sons, Sun Shipbuilding & Dry Dock Co. and City of Philadelphia.

Surveys show 32% of boilers now in service are 30 years old; 56% are over 20 years old

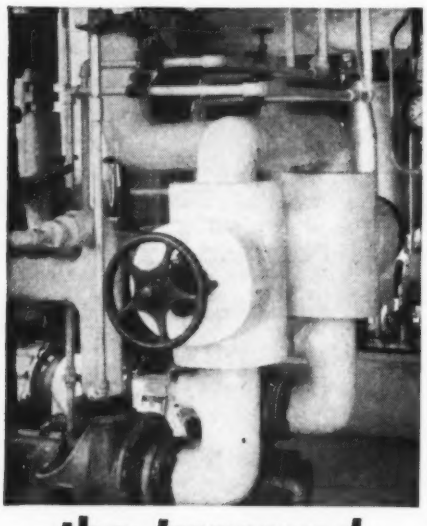
If your boiler fits this description, we recommend an immediate survey. "In 90% of the plants surveyed," summarizes Mr. Guzzardi, "we have found it possible to save thousands of dollars and to pay for the recommended improvements out of annual savings within one to three years."

Again and again the proved economy of Cleaver-Brooks four-pass, forced-draft boiler design results in savings reports as impressive as this. Contact your nearest Cleaver-Brooks representative for more facts on the complete line of steam and hot water boilers — 19 sizes, 130 models, 15 to 600 hp — for heating or processing. Or write Cleaver-Brooks Company, Dept. C, 321 E. Keefe Ave., Milwaukee 12, Wis., U.S.A. Cable Address: CLEBRO — Milwaukee — all codes

Cleaver Brooks

ORIGINATORS OF SELF-CONTAINED BOILERS

Swift's LAGGING ADHESIVES



the *Improved* Way to Adhere Insulation to Piping

For bonding insulation to piping or adhering lagging cloth to insulation, Swift's Improved Lagging Adhesives give you twelve important advantages—

1. EASY TO USE
2. FAST SETTING
3. NON-HAZARDOUS
4. FLAME-RESISTANT FILM
5. MOISTURE RESISTANT
6. MOLD RESISTANT
7. GOOD UNDERCOATING FOR PAINT
8. ADHESIVE PROPERTIES
9. FLEXIBILITY
10. SAVES PAINT
11. UNIFORM
12. MEETS ACCEPTED SPECIFICATIONS

The only sure way to find out what these advantages can mean to you is by a trial order. You can get a trial size supply at the quantity price. Write for details. SWIFT & COMPANY, Adhesive Products Department, 4115 Packers Ave., Chicago 9, Ill.

Swift

102ND YEAR

To Serve Your Industry Better

posed construction of a two-level structure adjacent to 1247-foot long Pier 9. $2,000,000. Client, American President Lines, Jersey City, N. J.

Preparation of contract drawings and specifications for 10,000-foot section of divided, four-lane highway — connecting link between existing stretches of four-lane roadway on U. S. Route 22. Client, The State of New Jersey.

Re-design high speed interchange of Route 22 with N. J. Route 69 at Clinton Point. Approx. 4000 ft long, requiring six structures; four highway overpasses and two stream crossings. Preparation of definitive plans and right-of-way drawings. Client, The State of New Jersey.

H. G. Metzger, Jr. & Associates, Huntingdon Valley, Pa.
Mechanical services, Kocsak residence, Allentown, N. J. $50,000. Client, Franklyn B. Spiezle, Architect.

Mechanical services, Helbig residence, Pennington, N. J. $30,000. Client, Franklyn B. Spiezle, Architect.

Fred S. Dubin Associates, Hartford. Medical Arts Building. Plumbing, heating, ventilating, air conditioning, electrical. Paterson, N. J. $1,500,000. Client, Fordyce & Hamby, Architects.

Howard Johnson motor lodge. Electrical engineering. Ridgefield Park, N. J. $350,000. Client, Carl Koch Associates.

G. B. Gusrae, New York, N. Y.
Office building, Paterson, N. J. New elevator installation. $30,000. Client, New Jersey Bell Telephone Co.

Day & Zimmermann, Inc., Philadelphia. Block iron plant, Mt. Hope, Dover. $2,000,000. Client, Shahmoon Industries.

Electronics manufacturing building, Moorestown, N. J. $750,000. Client, Radio Corporation of America.

NEW MEXICO

W. F. Turney and Associates, Santa Fe, N. M.
Sewage treatment plant. $807,000. Client, City of Albuquerque, N. M.

Water filtration plant. $314,000. Client, City of Alamogordo, N. M.

Water line. $600,000. Client, U. S. Air Force, N. M.

Reservoir and pipeline. $1,000,000. Client, U. S. Air Force, N. M.

Pipeline. $350,000. Client, City of Alamogordo, N. M.

Bridgers & Paxton, Albuquerque, N. M. 46-bed addition and two operating rooms. Presbyterian Hospital, Albuquerque, N. M. Client, Ferguson-Stevens, Architects.

100-bed base hospital. Walker Air Force Base, Rosewell, N. M. Client, Clark & Register, Architects.

75-bed hospital, Public Health Service, Shiprock, N. M. Client, W. C. Kruger, Architect.

Dr. Marcello Giomi, P.E., Albuquerque. Telephone building addition, Farmington, N. M. Air conditioning and plumbing. $200,000. Client, Ferguson, Stevens & Assoc.

400-man dormitory, University of New Mexico, Albuquerque, N. M. Air conditioning and plumbing. $1,500,000. Client, Schaefer, Merrell & Assoc.

Science wing, classroom wing, and girls' physical education building, Alamogordo High School, Alamogordo, N. M. Heating, air conditioning, and plumbing. $350,000. Client, Walgamood & Millington.

NEW YORK

G. B. Gusrae, New York, N. Y.
Conversion of existing attendant operated elevators to latest design fully automatic elevators with electronic automatic controls and dispatching system on following projects:

American Stock Exchange Building, New York City. $250,000. Client, Harry M. Prince, Architect.

Office building, New York City. $150,000. Client, Brause, Inc.

Loft and office building, New York City. $20,000. Client, 889 Broadway Corp.

Loft and office building, New York City. $65,000. Client, Alper Management Co.

Loft and office building, New York City. $65,000. Client, Alper Management Co.

Loft and office building, New York City. $60,000. Client, Alper Management Co.

Loft and office building, New York City. $30,000. Client, Premier Textile Co.

Lift and office building, New York City. $30,000. Client, Litecraft Co.

Robert Rosenwasser, P.E., New York. Structural design, 9-story, lightweight (Lelite), reinforced concrete, flat plate construction. 120,000 sq ft. $2,500,000. Client, Montefiore Hospital, Bronx, N. Y., owner, and Schuman and Lichtenstein, Architects.

Structural design, 13-story, reinforced concrete apartment building, flat plate construction. New York City. $1,500,000. Client, Joseph P. Blitz, Inc., owner, and H. I. Feldman, Architect.

J. Wylly Keck, Jr. & Associates, Atlanta, Ga.
General economic and application study including heat balances and cycles for Mark TA gas turbine. Olean, N. Y. Client, Clark Brothers Co.

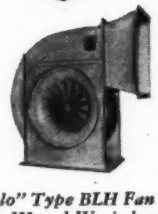
Fred S. Dubin Associates, Hartford, Conn.
Chapel-Stuart Air Force Base. Plumbing, heating, ventilating, electrical.

FANmail!

In every mail come queries to the "Buffalo" Engineering Department about air handling problems — everything from ventilating storerooms to handling highly corrosive fumes.

It's the job of this Department to recommend the best possible equipment to solve the problem to the greatest satisfaction. And "Buffalo" Engineers do just that, day in and day out. To answer your questions, they have the know-how of 80 years at their disposal, plus the most complete line of quality specialized industrial fans in the business — the "Buffalo" line. The results bring another kind of fan mail — enthusiastic reports of full satisfaction from contractors, engineers and plant officials in every field.

On your next air problem get the best answer by sending us *your* "fan mail" — the inquiring kind — and we'll do our best to deserve the other kind!



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Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo"

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING

LOWER COST WASHING FACILITIES

For Industry, Schools, Colleges, Institutions

FIRST IN SANITARY WASHROOM FACILITIES

Women like Bradleys

In Factories, Schools, Colleges, Camps and Public Buildings—You'll find Bradleys

Bradleys provide major economies:—more wash-up facilities in less space, lower water consumption, and 80% savings in piping connections.

Foot-control eliminates all hand contacts except with the clean spray of running water. And the self-flushing bowl prevents collection of contaminating water, reducing chance of spreading Dermatitis and other infections.

You can install Bradleys in new or existing buildings, in main washrooms and various other locations for greater convenience. For complete specifications, write for Catalog 5601.

BRADLEY WASHFOUNTAIN CO.,
2339 W. Michigan St.,
Milwaukee 1, Wis.

BRADLEY washfountains

Write for Catalog 5601

Distributed Through Plumbing Wholesalers

West Point, N. Y. $150,000. Client, Sirof & Rosenberg, Architects.

University of Buffalo, Nuclear Research Building, Buffalo, N. Y. Plumbing, heating, ventilating, air conditioning, contaminated waste disposal. $1,000,000. Client, Paul Schweikher, Architect.

Saito Restaurant. Plumbing, heating, ventilating, air conditioning, electrical. New York, N. Y. Client, Leavitt, Henshell & Kawai, Architects.

Parsons, Brinckerhoff, Hall & Macdonald, New York, N. Y.
Study engineering feasibility of adding additional traffic lanes to existing six-lane divided roadway of Grand Central Parkway, in a nine-mile long section between Astoria and Queens Village. Client, Grand Central Parkway, Long Island, N. Y.

Goodkind & O'Dea, New York, N. Y. North-south arterial highway, Utica, N. Y. Seven structures, including 1600-ft viaduct. $5,500,000. Client, Dept. of Public Works, State of New York.

Ford, Bacon and Davis, New York, N. Y. Design one-story square building, 360 ft on a side with second story section housing cafeteria and offices. Completely air conditioned, latest developments in lighting, and completely new machinery. Client, Homelite, Div. of Textron, Inc., Port Chester, N. Y.

William T. Ingram, Whitestone, N. Y. 1600-ft sanitary sewer, portion of Trunkline A in Greece. $23,000. Client, Town of Greece, Monroe County, N. Y.

Galson & Galson, Syracuse, N. Y.
30,000 sq ft red brick 2-story laboratory including two fully instrumented test rooms for fan-coil apparatus handling better than 30,000 cu ft of air per min. Client, Carrier Corp., Syracuse.

A. F. Gagne, Jr., Associates, Binghamton, N. Y.
Power-operated 4-way tilting operating table for 500-lb animals. $10,000. Client, Cornell University, N. Y. State Univ., School of Veterinary Medicine.

60-ft antennas for ionosphere radar research. $10,000. Client, Cornell Univ.

James N. De Serio, Buffalo, N. Y.
University of Buffalo, Sherman Hall. 4-story reinforced concrete frame addition to Medical and Dental School. $1,600,000. Client, James, Meadows & Howard, Architects.

Otto J. Sambach & Warren A. Sambach, Queens Village, N. Y.
Fuel oil terminal and 700-ft long dock. Long Island Sound. Client, Northville Dock Corp.

Herman Kron, P. E., New York, N. Y. Erect 1-story garage including roof parking deck, approximately 102 x 139 ft. First floor to be storage garage, auto repairs, gas station, and office. Cellar floor to be used as storage for cars. Steel and concrete, fireproof, face brick, overhead oil fired heater. $150,000. Client, L. B. Oil Co., Inc.

John Lowry, Inc., New York, N. Y. Modernizing five buildings comprising one block, New York, N. Y. $12,000,000. Client, Guaranty Trust Co. of N. Y.

New building for IBM World Trade Corp., New York, N. Y. $2,500,000. Client, IBM World Trade Corp.

Time & Life Building, New York, N. Y., joint venture with **George A. Fuller Co.** $50,000,000 (est.) Client, Rockefeller Center, Inc.

NORTH CAROLINA

Harwood Beebe Co., Spartanburg, S. C. New water supply involving small dam, 1 million gpd filtration plant. 12- and 10-in. supply mains. $335,580. Client, Franklin, N. C.

Morris, Boehmig & Tindel, Inc., Atlanta, Ga.
Sears Roebuck store, Rocky Mount, N. C., structural steel frame. $600,000. Client, Stevens & Wilkinson, Architects, Atlanta, Ga.

William M. Wallace, II, Durham, N. C. Third addition to Medical Research Building, Duke Hospital, Duke University, Durham, N. C. Plumbing, heating, and electrical. 80 x 40 ft, 4-stories. $250,000. Client, George F. Hackney, Architect, Durham, N. C.

Carolina Tel. & Tel. Co. Kinston, N. C. central office building. Plumbing, heating, electrical, air conditioning. $500,000. Client, Thos. B. Herman, Architect, Wilson, N. C.

Addition to Rocky Mount central office building. Plumbing, heating, air conditioning, electrical. 82 x 40 ft, 2-story building and basement. $200,000. Client, Thos. B. Herman, Architect.

OHIO

Willard F. Schade & Associates, Cleveland, Ohio.
Water plant expansion. $300,000. Client, Village of Newton Falls, Ohio.

Sewage treatment plant, Solon, Ohio. $500,000. Client, County of Cuyahoga.

Sewage treatment plant. $500,000. Client, Village of Bedford Heights, Ohio.

Day & Zimmermann, Inc., Philadelphia. Glass plant, Greenville, Ohio. $4,000,000. Client, Corning Glass Works.

Mayer & Valentine, Cleveland, Ohio. Heating, ventilating, and air conditioning system for additions to Plant No. 2 of General Motors Corp. Euclid Div., Euclid, Ohio. $220,000. Client, General Motors Corp.

Heating, ventilating, air conditioning, and plumbing systems for medical building, Akron City Hospital, Akron, Ohio. $1,500,000. Client, Wagner & Luxmore, Architects, Akron, Ohio.

"We should've had this stuff on the ramp years ago."

Flooring of ramp is A.W. ALGRIP—world's only abrasive rolled steel floor plate—and today's safety record tells the ALGRIP story.

ALGRIP provides super-safe footing under the *most hazardous* slipping conditions—on flat or *inclined* surfaces. It's made by a patented process in which a grinding-wheel type abrasive is rolled—*not coated*—to a controlled depth as an integral part of tough steel plate. Usage merely exposes more non-slip abrasive surface.

To eliminate accidents on ramps, loading docks and wherever slipping hazards exist in your plant, specify A.W. ALGRIP. Make a test installation. Use ALGRIP as an overlay or as independent flooring. It fabricates easily, requires no maintenance and will soon pay for itself in reduced accident and insurance rates.

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ALGRIP—approved for safety by Underwriters' Laboratories

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A.W. SUPER-DIAMOND rolled steel floor plate—Plates—Hot and cold rolled sheet and strip—(Alloy and Special Grades)

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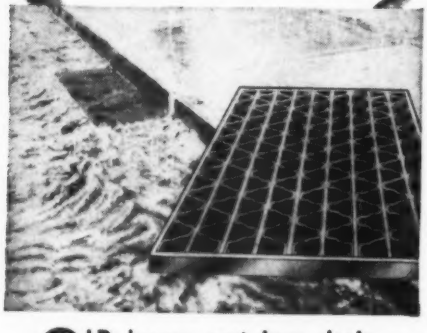

OLD heavy cast iron draingrates, averaging at best 40% clear opening, often fail to carry off rain water fast enough during heavy downpours, resulting in flooded highways—particularly at underpasses. Also, cracked draingrates must be replaced.

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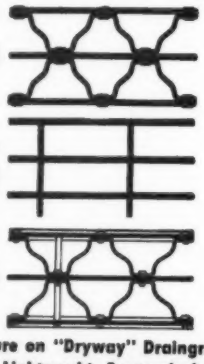
Available in three basic designs:

Riveted

Pressure-Locked

RI-6



Write for brochure on "Dryway" Draingrates
Self-maintaining, Lightweight, Economical, Safe

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IRVING SUBWAY GRATING CO., Inc.
Originators of the Grating Industry

Offices and Plants at
5056 27th St., LONG ISLAND CITY 1, N. Y.
1856 10th St., OAKLAND 23, CALIFORNIA

Heating, ventilating, and air conditioning system, Museum of Natural History, Cleveland, Ohio. $1,250,000. Client, Garfield, Harris, Robinson & Schaffer, Architects, Cleveland, Ohio.

Frankenberger, Junker and Lensky, Cincinnati, Ohio.
3-story chemical process building, 40 x 50 x 50 ft high, including outside utilities, foundations for tank farm, and cooling towers. Cincinnati, Ohio. $175,000. Client, Emery Industries, Inc.

PENNSYLVANIA

Day & Zimmermann, Inc., Philadelphia.
Northeast incinerator, Philadelphia, Pa. $416,000. Client, City of Philadelphia.

Boiler plant, Pottstown, Pa. $600,000. Client, Firestone Tire & Rubber Co.

Iron ore conveyor, Philadelphia, Pa. $425,000. Client, Pennsylvania Railroad.

Blocked iron plant, Philadelphia, Pa. $2,000,000. Client, Blocked Iron Corp. of America.

Garfield E. Smith-Chester Valley Engineers, Paoli, Pa.
Bridges, two short spans—one 20 ft span, one 22 ft span. $8000 each. Client, Valley Township, Chester County, Pa.

Structural system for super market. (Prestressed system to replace steel used in present building.)

Extension to Pennsylvania Avenue (new road). $74,000. Client, Dowingtown Borough, Chester County, Pa.

Two apartments, structural design. Client, John B. Thompson, Architect, Ardmore, Pa.

Wm. H. Glasgow, York, Pa.
York County Court House, York, Pa. Additions and alterations. Mechanical includes removal of existing plumbing and heating equipment and completely new air conditioning, heating, and plumbing systems installed. $2,150,000. Client, Forres-Baer & Assoc.

Lutheran Home for the Aged, York, Pa. Heating and plumbing for 4-story brick building. $650,000. Client, Hamme & Lenker, Architects.

Walker-Yoemans Associates, Philadelphia, Pa.
Research laboratory, North Wales, Pa. Mechanical, electrical, air conditioning. $1,200,000. Client, Leeds & Northrup.

H. G. Metzger, Jr. & Associates, Huntingdon, Pa.
Alterations and additions, general construction, plumbing, heating, ventilating for paint shop facilities. $35,000. Client, Orianna Wagon Works, Inc., Philadelphia, Pa.

G. B. Gusrae, New York, N. Y.
Heinz store building. Conversion of existing attendant operated elevator to latest design fully automatic elevator with electronic automatic controls and dispatching system. Scranton, Pa. $60,000. Client, Heinz Co.

Gatter & Diehl, Harrisburg, Pa.
High school and two grade schools, Muncy, Pa. $1,250,000. Client, Muncy School Authority.

Hospital. $2,500,000. Client, Carlisle.

Hospital addition and new nurses' home. $2,500,000. Client, Harrisburg Hospital.

Steelton high school. $2,000,000. Client, Steelton Authority.

Parros & Pelley, Pittsburgh, Pa.
C. M. Musser elementary school, Sharon, Pa. $800,000. Client, Hunter, Heiges and Gross, Arch., Sharon, Pa.

Meyersdale joint high school, Somerset, Pa. $1,000,000. Client, Kring & Ross, Architects, Somerset, Pa.

Westmoreland County Museum of Art, Greensburg, Pa. $600,000. Client, Sorber and Hoone, Architects, Greensburg, Pa.

The Ballinger Co., Philadelphia, Pa.
22,000 sq ft of additions to Chambersburg Hospital, Chambersburg, Pa. Project includes extension of present fifth floor, two additional floors, and a new two-story building.

RHODE ISLAND

Castellucci & Galli, Inc., Pawtucket.
Doctors' office building. Repairs and alterations. Providence, R. I. $18,000. Client, Dr. Peter Mathieu.

Commercial building, new construction. Providence, R. I. $45,000. Client, Andre Martesian.

SOUTH CAROLINA

Harwood Beebe Co., Spartanburg.
Sewerage improvements including outfall sewers 12- and 15-in., collection sewers, 10- and 8-in., 3 lift stations. Client, Conway, S. C.

Fred S. Dubin Associates, Hartford, Conn.
Hilton Head Resort. Heating and ventilating. Hilton Head, S. C. Client, Sasaki & Associates, Architects.

TENNESSEE

Forrest & Cotton, Dallas, Texas.
Overlay existing aircraft parking apron, U. S. Naval Air Station, Memphis, Tenn. $2,200,000. Client, U. S. Navy.

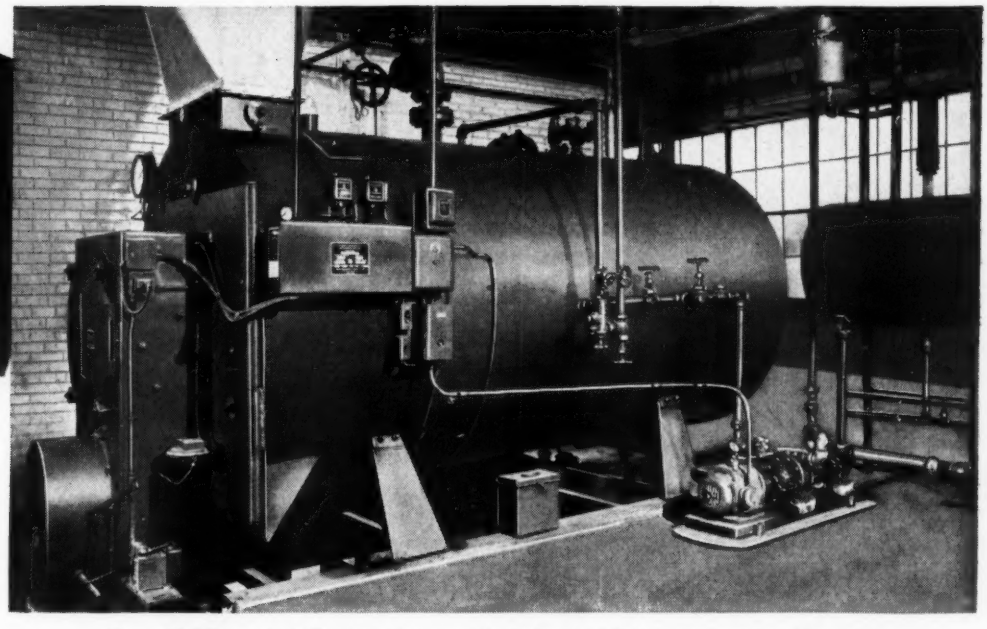
Morris, Boehmig & Tindel, Inc., Atlanta, Ga.
Federal Reserve Bank, Nashville, Tenn. Reinforced concrete frame. $1,800,000. Client, Toombs, Amisano & Wells, Architects, Atlanta, Ga.

TEXAS

Forrest and Cotton, Dallas, Texas.
Sewage treatment plant and outfall sewer. $1,150,000. Client, City of San Angelo, Texas.

Sewage treatment plant and outfall

"As an engineer, I know the advantages of SIMPLIFIED OPERATION in Packaged Boilers"



New 150-HP gas-fired Continental Automatic Boiler, installed in Progress Laundry, Dallas, Texas, reducing gas consumption more than one-third. Continental Boiler Distributor J. P. Philibert, Fort Worth, Texas. Installation by H. C. Lohman Machinery Co., Dallas, Texas.

"In designing or modernizing a boiler plant, simplicity of equipment usually means important savings in both labor and fuel. That's just another way of saying it pays to insist on Packaged Boilers.

"Controls are simplified and dependable, and they require practically no maintenance. Cleaning is simplified by easy access to burner and tubes. Air atomizing reduces burner maintenance to a minimum.

"Best of all, the responsibility for this simplified operation rests with one firm only — the manufacturer of the unit. So if we ever do need help, we know exactly where to get it."

Six Reasons Why it Pays to Buy a CONTINENTAL Automatic Boiler

* Guaranteed 80% efficiency . . . Fire-tested before shipment . . . Range, 20 to 500 hp.
* Simple, practical two-pass design, for uniform flow of combustion gases through all return tubes.
* Maximum radiant heat transfer achieved by "Spinning Gas" technique for thorough mixing of air and atomized fuel.
* High-CO_2 and low-temperature stack gases — proof of high combustion efficiency.
* Free, rapid water circulation improves heat transfer, keeps heating surfaces clean.
* Easy access to furnace and all return tubes. Refractory baffles and brickwork are not required.

For details on the Continental Automatic Boiler, send for Bulletin BE-3

BOILER ENGINEERING & SUPPLY COMPANY, INC.

1 Manavon Street, Phoenixville, Pa.

A HALF CENTURY OF BOILER MANUFACTURING EXPERIENCE

The Continental AUTOMATIC BOILER

sewer. $181,500. Client, City of Lewisville, Texas.

Central sewage system and treatment plant. $7,000,000. Client, Trinity River Authority of Texas.

Parsons, Brinckerhoff, Hall & Macdonald, New York, N. Y.
Study problem of cargo and personnel transfer between various offshore drilling structures and their service vessels. Client, Humble Oil & Refining Co., Houston, Texas.

Selection of location for initial highway on South Padre Island and the preparation of preliminary plans, specifications, and estimates of construction costs. Client, South Padre Island Highway, Texas.

C. T. Gilliam & Associates, Gonzales.
Design and construct polyurethane foam plastic plant. $400,000. Client, Texas Foam & Plastics Corp.

W. S. Merliss & Assoc., Houston, Texas.
Poultry processing plant, 21,000 sq ft. Concrete block, clay tile, glazed tile, rigid frames, bar joist. $275,000. Client, M. G., Inc., Weimar, Texas.

Fred S. Dubin Associates, Hartford, Conn.
University of St. Thomas, Houston, Texas. Master utilities plan for expansion, entailing 13 buildings. $500,000. Client, Philip C. Johnson, Arch.

University of St. Thomas, Houston, Texas. New addition and classroom building. Plumbing, heating, air conditioning, electrical. $500,000. Client, Philip C. Johnson, Architect.

University of St. Thomas. Plumbing, heating, ventilating, air conditioning, electrical. Phase II, Commons Building, class room buildings. Houston, Texas. $1,000,000. Client, Philip C. Johnson Assoc., Architects.

E. B. Mansfield Co., Pasadena, Texas.
Evaluation of natural gas supply and distribution systems, municipally owned. Client, City of Huntington, Texas.

The Fluor Corp., Ltd., Los Angeles.
Engineering, procurement, and construction of 80,000 bbl/day vacuum pipe still at Port Arthur, Texas. Client, The Texas Co.

Prengle, Dukler & Crump, Houston.
Gas processing plant with daily capacity of 100 mmscfd, Point Comfort, Calhoun County, Texas. $1,500,000. Client, Aluminum Company of America.

Scott Engineering Co., Forth Worth.
Engineering study of existing and proposed roads and streets on eight Air Force bases in Southwest Texas. Client, Fort Worth District, Corps of Engineers, U. S. Army, Southwest Div.

Preparation of plans and specifications for five AC&W (unmanned radar facilities) stations. $200,000 (est.). Client, Fort Worth District, Corps of Engineers, U. S. Army, Southwest Div.

Preparation of plans and specifications for five major street improvement projects. $1,175,000 (est.). Client, City of Fort Worth.

Mitchell, Hunt & Joiner, Dallas, Texas.
U. S. 77 Expressway in Dallas. Grading, structures, pavement. $7,000,000. Client, Texas Highway Department.

Grade separation structures, Loop 13 in San Antonio, Texas. $1,500,000. Client, Texas Highway Department.

VIRGINIA

Wiley & Wilson, Lynchburg, Va.
Dixie Hospital. 200-bed at Hampton, Va. on new site. $3,600,000. Client, Hampton School for Nurses, Inc.

Parsons, Brinckerhoff, Hall & Macdonald, New York, N. Y.
Preliminary engineering studies for new drydock to be used primarily for the building of large tankers. 1100 ft long, 150 ft wide, and 45 ft deep, designed to be built in shortest possible time. Client, Newport News Shipbuilding & Dry Dock Co., Va.

William A. Brown, Washington, D. C.
Additions to John Randolph Hospital at Hopewell, Va. Brick and concrete wings. $750,000. Client, Hopewell Hospital Authority.

Morris, Boehmig & Tindel, Inc., Atlanta, Ga.
Sears Roebuck store, Lynchburg, Va. Reinforced concrete frame. $900,000. Client, Stevens & Wilkinson, Architects, Atlanta, Ga.

General Engineering Associates, Washington, D. C.
Garden Apartment Project, 120 units, Arlington, Va. Mechanical and electrical. $1,800,000. Client, Corning & Moore, Architects.

William M. Wallace, II, Durham, N. C.
Norfolk Coca Cola Bottling Co. bottling plant. Plumbing, electrical, air conditioning and heating, refrigeration, and bottling equipment. $800,000. Client, A. Ray Penticost, Architect, Norfolk, Va.

WASHINGTON

George M. Frese, Wenatchee, Wash.
Project and design engineer for the Manson, Wash. television translator experimental broadcast station. $20,000. Client, Manson Community TV Assoc.

Willard Johnson, Pasco, Wash.
Downtown fluorescent street lighting system for City of Prosser, Wash. $20,000. Client, Benton County Public Utility District.

KOHLER ELECTRIC PLANTS

Don't let power failure leave hospitals, schools, stores, public and commercial buildings unprotected

Model 35R81,
35 KW, 120/208 volt AC.
Remote starting.

Put Kohler electric plants in your specifications to insure stand-by power when storms or accidents cause central station stoppage.

Hospitals need Kohler plants for operating room lights, nurses' call bell systems, iron lungs, sterilizers, equipment vital to patients' care. Schools, stores, theatres use them to prevent sudden darkness; homes for automatic heat, water systems, refrigeration. They prevent costly interruptions in countless enterprises. Civil Defense units need them for first aid stations, fire and rescue trucks, mobile hospitals. Sizes 1000 watts to 50 KW. Write for specification data 20-D.

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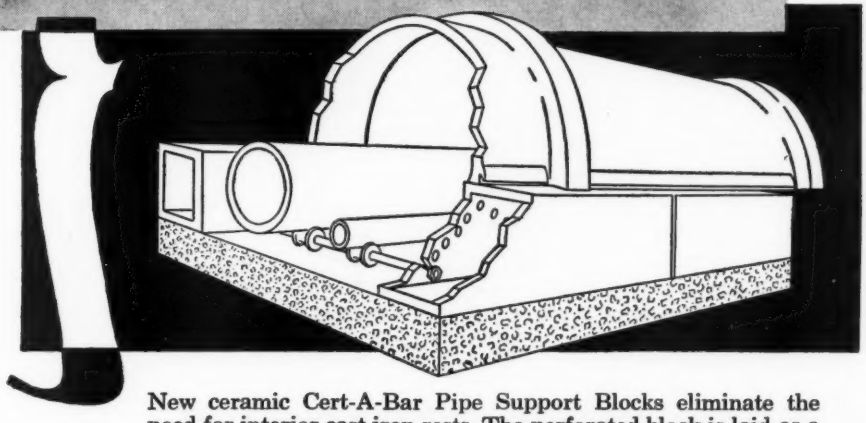
Established 1873

Plumbing Fixtures • Heating Equipment • Electric Plants • Air-cooled Engines • Precision Controls

KOHLER OF KOHLER

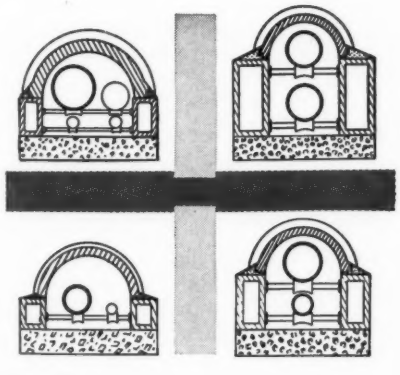
PERMANENT PROTECTION
for underground piping!

STILLWATER CERT-A-BAR* TUNNEL CONDUIT SYSTEM



New ceramic Cert-A-Bar Pipe Support Blocks eliminate the need for interior cast iron rests. The perforated block is laid as a structural support member at regular intervals, and the bars are simply inserted and locked in place.

THE vital consideration in selecting an underground conduit system is *permanent* protection . . . not for one year or five, *but for the life of the piping.* You get the best possible protection for your underground metal service piping with a Stillwater Conduit System of vitrified clay. It's chemically inert—can't rust, rot, corrode, or decay . . . ever. And it is manufactured in accordance with ASTM specification C-13-54, assuring proper strength and quality. Any combination of service piping can be protected. Conduit is available in a wide range of sizes, with a complete line of fittings and accessories, including alignment guides, lateral guides, and anchors. Any contractor's crew can handle the installation easily, or if you prefer, Stillwater Licensed Installers will assume the responsibility. The Cert-A-Bar Tunnel System can be installed with any of three suggested new waterproofing specifications —one for average conditions, one for intermittent ground water conditions, and a third for high water table conditions. It's the lowest-cost conduit per year of service that you can specify or install!



THE CERT-A-BAR SYSTEM HAS ALL THESE IMPORTANT ADVANTAGES

- Inherent structural strength for permanent protection
- Complete flexibility for design
- Minimum initial and long-term costs
- Quickly installed
- Keeps pipe insulation dry
- No electrolytic corrosion of piping
- No maintenance required

A few of the hundreds of possible combinations of piping for the Cert-A-Bar Tunnel System are shown at left.

WRITE FOR

illustrated, four-page circular with complete installation specifications.

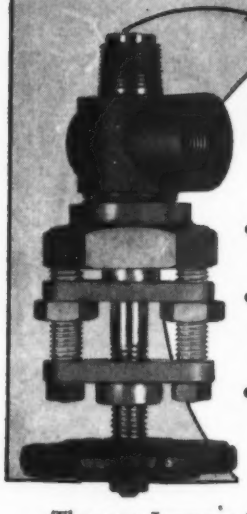
*T.M. Reg. App. For.
Patents Pending

The Stillwater Clay Products Co.
STILLWATER CONDUIT DIVISION
3334 PROSPECT AVENUE, CLEVELAND 15, OHIO

SW-956-70A

STILLWATER CONDUIT SYSTEMS

New! Jerguson Drain or Sampling Valve



- completely self-draining
- withstands severe conditions
- foolproof operation

¾" size shown

The new Jerguson No. 23 Drain or Sampling Valve is completely self draining, for the valve stem seats on the outside of the valve body. It is ideal for installations where it is desirable to have the valve seat inside the wall of a vessel in order to prevent the typical condition of liquid remaining in the nipple and valve inlet.

This rugged, new Jerguson Valve has outside screw and yoke construction to meet high temperature or corrosive conditions where inside threads cannot be tolerated. The efficient outside thread design eliminates possible freezing and allows the valve stem to work freely at all times. The No. 23 Valve provides foolproof operation because the stem is constructed with a left-hand thread, thus allowing the valve handle to operate in the normal direction of standard valves.

Available in sizes from ¾" to 2" N.P.T. ¾" and 1" sizes are recommended for pressures of 4000 lbs. @ 100° F. and 1000 lbs. @ 750° F.; 1¼, 1½ and 2" sizes are recommended for 600 lbs. @ 100° F. and 250 lbs. @ 750° F. Optional features include construction with additional outlet for such uses as a steaming out connection and with a reamer on the end of the stem to break away encrusted matter which may have collected on the inside vessel wall.

Write for data unit and complete details.

JERGUSON

Gages and Valves for the Observation of Liquids and Levels

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100 Adams Street, Burlington, Mass.
Offices in Major Cities
Jerguson Tress Gage & Valve Co., Ltd., London, Eng.
Pétrole Service, Paris, France

Gellert, Griffin, Williams & Assoc., Seattle, Wash.
Design jet fuel system. Fairchild Air Force Base. $1 million. Client, Army Engineer Corps, Seattle, Wash.

Five sewage pumping stations. $500,000. Client, City of Seattle, Wash.

65-mile oil pipeline, north of Seattle. Client, Trans Mountain Oil Pipe Line Corp., Wash.

Harry E. Roller, Seattle, Wash.
Home for the retired, 50 units. Preliminary design stage only. $400,000. Client, non-profit corporation.

Holmes & Narver, Inc., Los Angeles.
Design, engineer, and construct catalytic reformer at Tacoma, Wash., oil refinery. $750,000. Client, U. S. Oil & Refining Co.

Carey & Kramer, Seattle, Wash.
Dry dock #6, Puget Sound Navy Yard, Bremerton, Wash. Length, 1150 ft, width, 205 ft, width of moles, 300 ft (includes 3 piers). Joint venture with **Moran, Proctor, Mueser & Rutledge,** N. Y. C. $36,000,000. Client, U. S. Navy.

Tolt River Dam located about 50 miles from Seattle. $7,000,000. Client, City of Seattle, Wash.

WEST VIRGINIA

Parros & Pelley, Pittsburgh, Pa.
Jackson junior high school, Vienna, W. Va. $600,000. Client, Charles J. Ross, Architect, Parkersburg, W. Virginia.

West side elementary school. Classrooms, central heating plant for new and existing school buildings. $150,000. Client, Board of Education, Bloomer.

Sunday school addition. Classrooms, social room, and offices. $100,000. Client, Board of Trustees, Hope Lutheran Church, Eau Claire, Wis.

WISCONSIN

E. F. Klingler & Associates, Inc., Eau Claire, Wis.
Elementary school, Catawba, Wis. Classrooms, all-purpose room, kitchen, and offices. $130,000. Client, Board of Education, Jt. Dist. #1, Phillips, Wis.

Fargo Engineering Co., Jackson, Mich.
Preliminary planning stage on hydroelectric plant located on the Chippewa River, Wis. Application for Preliminary Permit has been made to Federal Power Commission so that more extensive field investigation may be made. $13,500,000. Client, Dairyland Power Cooperative, La Crosse, Wis.

FOREIGN

R. W. Beck and Associates, Seattle.
Hydroelectric rehabilitation at Ketchikan, Alaska. One concrete diversion dam, one reinforced concrete intake structure, 370 ft of 36-in. steel penstock, installation of a new 2500-hp turbine, and 1750-kva generator with revisions to switchgear and switchyard. $1,000,000. Client, Ketchikan Public Utilities, Ketchikan, Alaska.

Hugh M. Lyman, Salt Lake City, Utah.
New temple and college, 1300-acre tract site in New Zealand. $8,000,000 (est.) Client, Church of Jesus Christ of Latter Day Saints.

Parsons, Brinckerhoff, Hall & Macdonald, New York, N. Y.
Basic design of electrical and mechanical equipment for two 6500-foot long, two-lane tunnels and two 1480-foot long tunnels. Client, Jardim Botanico-Cosme Velho-Paulo de Frontin Tunnels, Rio de Janeiro, Brazil.

Development and design of new port to serve the City of Guayaquil. Preliminary economic and engineering report to establish master plan for port, with preliminary designs and cost estimates; forecast future income; plan program for financing and present conclusions on the economic justification. Client, Puerto Nuevo, Ecuador.

Fred S. Dubin Associates, Hartford, Conn.
American Embassy. Plumbing, heating, ventilating, electrical. Dublin, Ireland. $600,000. Client, U. S. State Department and John MacL. Johansen, Arch.

Historical Gunpowder Caverns. Air conditioning and moisture control. Bermuda, B.W.I. Client, Salisbury Construction Co., Ltd., Hamilton, Bermuda.

Chemical and Industrial Corp., Cincinnati, Ohio.
Construction of 250-ton per day nitric acid plant to be built at Stanford-le-Hope on the Thames estuary. Client, Fisons, Limited, Suffolk, England.

General Engineering Associates, Washington, D. C.
American Embassy office building, Athens, Greece. Mechanical and electrical. Client, The Architects Collaborative, Cambridge, Mass.

American Embassy, Baghdad, Iraq. Mechanical and electrical. Client, Jose Luis Sert, Cambridge, Mass., Architect.

Gerald J. Spolter, Miami Beach, Fla.
Office building, 6-story, structural steel frame on spread footing foundation. Nassau, Bahamas. $275,000. Client, Carlos B. Schoeppl, Architect, Miami, Fla.

Carey & Kramer, Seattle, Wash.
Sitka hydroelectric project at Sitka, Alaska. Work includes 200-ft high dam, 6000 feet of 10-ft tunnel and 6000-kw power station. $4,000,000. Client, City of Sitka, Alaska.

Kaiser Engineers International, Inc., Oakland, Calif.
Four pumping plants, water treatment plant, four reservoirs, water distribution system, and electrical transmission line. Asuncion, Paraguay. Client, City of Asuncion. ▲▲

INSIDE STORY:

Why a Heat Exchanger Poses for an X-ray

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Books

For

Consulting Engineers

NUMERICAL ANALYSIS, by Zdenek Kopal; John Wiley & Sons, Inc.; 556 pp.; $12.00.

Reviewed by J. C. Bell
Research Mathematician
Battelle Memorial Institute

Kopal's book furnishes a readable introduction to several moderately advanced topics in numerical analysis, particularly those dealing with differentiation and integration with respect to one variable. The book is unusually full of explanations of why the mathematical problems are attacked by the methods described. When several approaches furnish different insights into a problem, Kopal proves ready to present them. This lengthy exposition makes the book relatively long, but it also should help the reader who must study the subject independently. For this reason the book may be appreciated not only by students, but also by engineers who find a need for numerical analysis.

After its introduction, the book describes several methods of interpolation based on polynomial approximation. Here, as throughout, primary attention is paid to the algebra, but illustrative numerical examples are included. A relatively short chapter treats numerical differentiation. Then a long chapter presents methods for integrating ordinary differential equations with conditions imposed at the origin. The methods include tabular differences, expansion in power series, successive extrapolation, and successive substitutions associated with automatic computers.

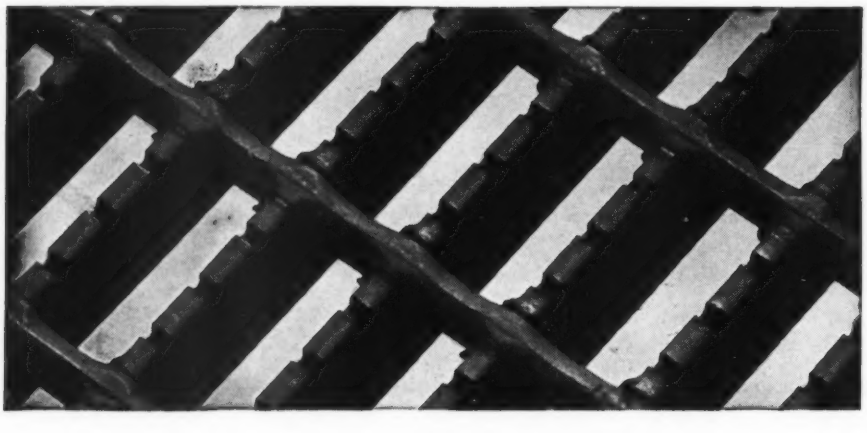
The solution of ordinary differential equations with boundary conditions at separated points occupies two chapters. Their main concern is to find characteristic numbers and functions with which solutions may be constructed. A variety of formulas provide various degrees of accuracy and complexity. A long chapter treats numerical evaluation of definite integrals. The first emphasis is on ideally efficient schemes, such as Gaussian and related quadratures; but plans for meeting other needs are described, such as the Newton-Cotes method for equally spaced abscissae. Good tables of coefficients are included for implementing the various quadratures. Finally, a chapter is devoted to integral and integro-differential equations, furnishing some general theory, plus plans for numerical solution using algebraic, iterative, and least-squares methods.

The introductory chapter is an essay on numerical analysis which should interest most engineers and mathematicians. It reviews the history of numerical reasoning, and pleads for its proper use today. The author observes that the classical mathematical analysis, depending strongly on linearity, often proves futile in modern scientific problems. He reasons that we should use the methods of infinitesimal calculus when they help, but should avoid them by a recourse to algebra (and hence numerical calculation) when the calculus becomes unmanageable. Modern computing machinery makes the latter course feasible.

ALSO AVAILABLE

NATIONAL PLUMBING CODE HANDBOOK: STANDARDS AND DESIGN INFORMATION, edited by Vincent T. Manas, Consulting Engineer; McGraw-Hill Book Co., Inc.; 544 pp.; $7.50.

Based on National Plumbing Code ASA A40.8, this handbook explains and illustrates the meaning and intent of the Code. It includes related technical information and data to aid in design and installation of



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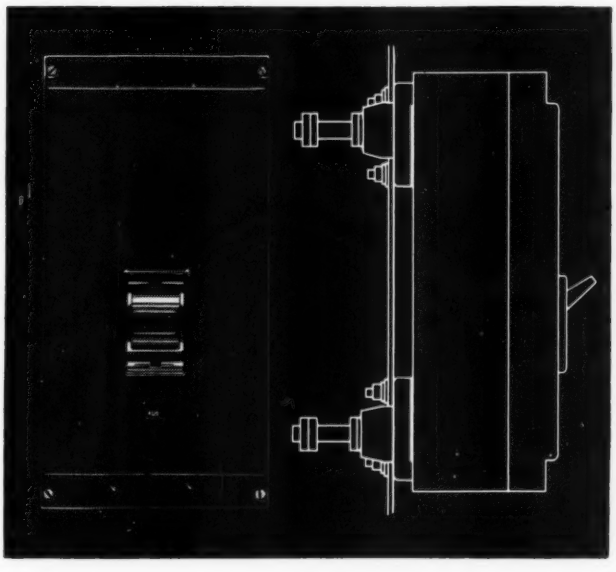

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plumbing, water supply, sewage, and drainage systems that will meet Code requirements. Chapters relating to research and special technical material were written by Herbert N. Eaton, formerly chief, Hydraulics Laboratory, NBS.

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NATIONAL FIRE CODES, ELECTRICAL, Vol. V; National Fire Protection Association; 704 pp., $6.00 ($4.50 to NFPA members).

This book gives the complete official text with tentative interim amendments adopted by the National Electrical Code Committee to July 30, 1956, and an index to electrical provisions of other NFPA Standards, plus:

NFPA No. 71. "Central Station Protective Signaling System, 1956 Edition."

NFPA No. 72. "Proprietary, Auxiliary, Remote Station, and Local Protective Signaling Systems, 1956 Edition."

NFPA No. 73. "Municipal Fire Alarm Systems, 1956 Edition."

NFPA No. 74. "Automatic Fire Alarm Systems for Private Dwellings."

NFPA No. 77. "Static Electricity."

NFPA No. 78. "Code for Protection Against Lightning."

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ON HUMAN COMMUNICATION, by Dr. Colin Cherry; John Wiley & Sons, Inc., and The Technology Press of MIT; 333 pp.; $6.75.

This book constitutes a review of recent trends in the study of this subject, as it appears in phonetics, linguistics, information theory, experimental psychology, and semantics. It examines various communication sciences, how they relate to each other, and the areas open to further investigation. Dr. Cherry is currently Henry Mark Pease Reader in Telecommunication at the Imperial College of the University of London. He has done extensive research in mathematics, electrical telecommunication, linquistics, and experimental psychology.

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ALUMINUM IN MODERN ARCHITECTURE, two volumes, by John Peter and Paul Weidlinger; Reinhold Publishing Corp.; 255 pp. (Vol. I), $10.00; 403 pp. (Vol. II), $17.50; $25.00 set.

Volume I, "Buildings," pictures aluminum as used in over one hundred buildings throughout the world. Text explains where and why aluminum was selected for each building. Included are extracts from tape recorded conversations with twenty-six well known architects on the future of aluminum in modern architecture.

Volume II, "Architectural Engineering," is a technical handbook of aluminum engineering, design, and detail. It represents organization and editing of architectural aluminum data from all important aluminum producers and fabricators in this country and abroad, and includes the standards adopted by the industry associations. Besides practical aids on costs and specifications, it discusses original research now being carried on.

The two volumes were prepared under sponsorship of Reynolds Metals Co.

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The following publications on urban renewal are available from the Superintendent of Documents, Government Printing Office, Washington 25, D.C.

"Urban Renewal—What It is," 12 pp., 10¢, Catalog No. HH 1.2: Ur ½.

"Replacing Blight With Good Homes," 12 pp., 10¢, Catalog No. HH 1.2:B 61.

"The Workable Program—What It Is," 8 pp., 10¢, Catalog No. HH 1.2:P 94/3.

"How Localities Can Develop a Workable Program for Urban Renewal," 12 pp., 10¢, Catalog No. HH 1.2:Ur 1/955-2.

"Comparative Digest of Municipal and County Zoning Enabling Statutes," 70 pp., 60¢, Catalog No. HH 1.2:Z 7.

"Slums and Blight . . . A Disease of Urban Life," 22 pp., 15¢, Catalog No. HH 7.3:2.

"Provisions of Housing Codes in Various American Cities," 31 pp., 75¢, Catalog No. HH 7.3:3.

"Approaches to Urban Renewal in Several Cities," 31 pp., 25¢, Catalog No. HH 7.3:1.

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MATHEMATICS REFRESHER FOR PROFESSIONAL ENGINEERS' AND LAND SURVEYORS' LICENSE, by John D. Constance, P.E.; DeTroy Press, Inc.; paperbound; $2.00.

The problems in this book are complete with solutions and are based on a survey of problems appearing in examinations in a number of states. Information is given on the various types of problems that can be expected in examinations so that further work on the various types can be done with standard reference textbooks.

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"Fly Ash for Use As a Construction Material," available from Bituminous Coal Research, Inc. for $1.00, has been prepared as a handbook including sources, specifications, and present uses of fly ash. Address of the Bureau is 121 Meyran Ave., Pittsburgh 13, Pa.

FILMS

"THE EIGHTH SEA," Caterpillar Tractor Co., sound and color, 28½ min.

The story of the planning and development of the St. Lawrence Seaway is narrated by Walter Cronkite in documentary style in this new film. It shows construction of coffer dams and the method used in diverting the river from its natural bed. The film is available from the Advertising Division of Caterpillar Tractor Co., Peoria, Ill.

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"ELECTRONIC COMPUTERS IMPROVE MANAGEMENT CONTROL," University Extension, University of California, 16 mm, sound and color, 15 min.

This film describes the use of computers for improving and controlling production procedures, explaining potentials of electronic data processing techniques to businesses.

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As a readers' service, CONSULTING ENGINEER will order reviewed books or any other technical volumes. In ordering books, give title, author, and publisher and enclose check. Address is 227 Wayne St., St. Joseph, Michigan.